

LA REVUE AGRICOLE

DE

L'ILE MAURICE

RÉDACTEUR : G. A. NORTH COOMBES

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MAURICE

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P. 57 ligne 27 au lieu de " 3 o/o " lire " 8 o/o ".

P. 58 „ 24 „ " Rs 3 60 " lire " Rs 360. ".

P. 92 Remplacer le para 3 par : " M. Adrien Wiehe dit qu'il a également observé l'action nocive des sels de cuivre formés après la disparition de l'étamage des appareils à levain pur. Il demande si M. Raffray a fait des essais avec du fluorure de sodium comme bactéricide. "

P. 92 Remplacer le para 8 par : " M. Staub dit qu'avec la carbonatation il faudrait employer quarante fois plus de chaux qu'avec la simple défécation et qu'il faudrait importer des pierres à chaux. La question de combustible en distillerie devrait être examinée, d'autant plus que les ressources forestières de la colonie ont diminué d'une façon inquiétante. "

P. 92 ligne 30 au lieu de " du bois comme combustible " lire " du combustible en distillerie. "



M. P. O. WIEHE Msc., A.R.C.S., F.L.S.

Dans le courant du mois de mars M. P.O. Wiehe, rédacteur de la Revue Agricole depuis 1940, accepta son transfert comme phytopathologiste au Nyassa, et fit parvenir sa démission au Comité de Rédaction.

Paul Octave Wiehe est né en 1910. Il fit ses études scolaires au Collège St. Joseph et se fit ensuite admettre au Collège d'Agriculture dont il fut proclamé lauréat en 1930. De 1930 à 1934, Wiehe fit de solides études scientifiques à l'Imperial College of Science and Technology se spécialisant en botanique. Après un stage au Plant Breeding Station d'Aberystwyth, où il s'attacha particulièrement à l'étude de l'amélioration des pâturages, Wiehe retourna en son île natale et entra dans le service civil de la colonie comme professeur de biologie au Collège Royal. Il était en même temps chargé des cours d'écologie au Collège d'Agriculture, et faisait une étude préliminaire des pâturages de l'île qui constitua, comme l'écrivit M. G.E. Bodkin, " the first survey of the pasture lands of Mauritius in the light of modern research. "

En 1938, le poste de phytopathologiste au Département de l'Agriculture devint vacant à la suite du départ de M. E.F.S. Shepherd pour la Côte d'Or. Wiehe fut choisi pour le remplir. Il y apporta toute sa science, tout son enthousiasme, toute son énergie et, pendant 19 ans qu'il occupa ces fonctions, il fut appelé à servir le pays à plus d'un titre. Ce fut d'abord la préparation, en collaboration avec le docteur R.E. Vaughan, d'une étude approfondie de la végétation de l'île Maurice ; puis, ce furent des travaux sur la végétation de l'île Rodrigues, qu'il visita en mission officielle en 1938 et 1941, et de nombreuses recherches sur les maladies de nos plantes industrielles principalement celles de la canne à sucre. Un peu plus tard c'était une étude complète, jusqu'ici inédite, de nos champignons. Enfin, sa mission en Amérique en 1945 en marge de la lutte contre l'envahissement de nos terres par l'herbe condé venait couronner son œuvre scientifique au service de l'agriculture mauricienne.

Cependant ce ne furent pas là les seules contributions d'Octave Wiehe au mieux-être de son pays. Il s'est donné une peine d'apôtre pour aider à identifier les plantes du Jardin des Pamplemousses qu'il catalogua. Pendant la guerre il fut longtemps sur la brèche comme l'un des principaux organisateurs de la production des denrées alimentaires sur une échelle jusqu'ici inconnue à l'île Maurice. Hier encore, c'est à lui qu'était confiée la compilation d'une documentation complète sur l'industrie sucrière pour les besoins de la Commission Economique. Enfin, Wiehe s'est dévoué pendant bientôt huit ans à la rédaction de la Revue Agricole.

Ce labeur intense trouve aujourd'hui sa récompense en la promotion qu'il vient d'accepter. Nous pouvons ajouter que son travail sur le plan scientifique avait déjà été reconnu par son Université qui lui avait conféré le degré de " Master of Science " en 1945 lors de son passage à Londres. Le jour ne saurait tarder où d'autres distinctions académiques viendront s'ajouter à celle-ci.

A des connaissances multiples, à une grande capacité de travail et à une science sûre et précise, Octave Wiehe allie une personnalité forte et sympathique caractérisée par une grande modestie. On ne lui connaît que des amis qui le verront avec regret s'éloigner de nos rives.

La Revue Agricole en remerciant Octave Wiehe pour ses services dans le passé lui offre ses vœux de succès complets dans l'avenir.

NOTES ET ACTUALITES

Personalia

La Revue Agricole souhaite la bienvenue à M. W. Allan, O.B.E. le nouveau directeur de l'Agriculture qui est arrivé par le K.P.M. "Tegelberg" le 19 mai. M. Allan nous arrive de la Nord-Rhodésie où il était assistant-directeur et entomologiste du service de l'Agriculture.

MM. L. Robert et G. R. Park, administrateurs des propriétés Bel Ombre et Bénarès respectivement, sont rentrés dans la colonie le 2 mai sur l'Umtata après un séjour en Afrique du Sud.

MM. P. G. Ducray, M. Labat, P. J. Toulet et E. C. Vignes ont terminé avec succès leurs études au Collège d'Agriculture. M. E. C. Vignes est sorti premier de sa promotion. L'année scolaire s'est ouverte avec 28 étudiants dont 11 sont en première année, 9 en deuxième et 8 en troisième. Les bourses d'entrée ont été attribuées à MM. J. Olivier et J. C. Cadet de Fontenay.

Chez les Filateurs

A une réunion du "Mauritius Hemp Producers' Syndicate" tenue le 16 avril, M. J. R. Maingard de Ville-ès-Offrans s'est retiré de la présidence en raison de son prochain départ pour l'Europe. M. Maingard a été président de ce syndicat depuis 1931. C'est l'honorable J. Philippe Lagesse, député des Pamplemousses, qui a été élu pour le remplacer. M. Lagesse est propriétaire de la filature de la Grande Rivière et s'intéresse beaucoup à la réalisation de défibreuses automatiques pouvant répondre aux besoins des filatures d'aloès.

Cyclone and Drought Insurance Fund

Au cours de la séance du Conseil Législatif du 4 mai, lors de la présentation du projet de budget de la colonie pour l'exercice financier 1948-49, l'honorable M. E. O'Connor, Secrétaire Financier, dit qu'il avait appris que la prochaine coupe atteindrait vraisemblablement le chiffre record de 400.000 tonnes. Si ces prévisions se réalisaient, les allocations pour les pertes subies par l'industrie sucrière à la suite des cyclones de 1944-45 auront été complètement liquidées en 1948-49, car la coupe 1947 a aussi été belle. M. O'Connor termina son discours en annonçant que le fonds du "Cyclone and Drought Fund" s'élevait maintenant à plus de 6 millions de roupies et qu'il atteindrait probablement 10 millions à la fin de l'année courante.

Sulfate d'alumine comme déféquant

Nous apprenons que des expériences vont être faites à Maurice dans

le courant de la coupe prochaine pour déterminer la valeur du sulfate d'alumine comme déféquant. Des expériences avec ce produit ont été faites à l'étranger l'année dernière. Le sulfate d'alumine se vend £ 11 par tonne, franco en gare Durban.

Destruction de l'Institut pour l'étude de la Canne à sucre de Passeroan (Java)

Chronica Botanica nous informe de la destruction récente de l'Institut de Passeroan (Est-Java) pour l'amélioration de la canne à sucre. Cet Institut célèbre, fondé vers 1890 par Borus, le célèbre bio-chimiste, avait obtenu des réalisations remarquables dans l'amélioration de la canne à sucre, dont le rendement grâce à ses recherches avait été porté de 4t. à l'ha. à 15 et même 18t. Les laboratoires, les archives, la bibliothèque, les collections incomparables ont été entièrement détruits par ordre des autorités indonésiennes. Cet Institut avait fourni les données les plus utiles sur les espèces hybrides de cannes, sur les maladies des plantes et les espèces résistantes à ces maladies, sur la protection des sols, sur l'irrigation, sur les engrais. Ses travaux étaient réputés dans le monde entier. C'est une perte irréparable pour la science appliquée.

(R.B.A. Nov-Dec. 1947)

Production Sucrière de Java

Le S.A. Sugar Journal de mars donne des renseignements intéressants sur les progrès de la reconstruction de l'industrie sucrière javanaise. En 1947 quatre usines roulèrent et produisirent 81,00 tonnes de sucre. En 1948 on espère que 33 usines fonctionneront donnant un total d'environ 100,000 tonnes de sucre à l'estimation. On envisage une production d'à peu près 350,000 tonnes pour 1949, c'est à dire couvrant tout juste les besoins de la consommation intérieure. Java ne pourra recommencer l'exportation de sucre qu'en 1950 et cela seulement si tout va bien entre la République et les Etats fédérés des Indes Néerlandaises.

Expansion de l'Industrie Sucrière au Sud-Afrique

Dans ses commentaires de mars 1948 l'LS J. attribue à l'évolution industrielle rapide du Sud-Afrique et au pouvoir d'achat grandissant de la population indigène une augmentation sensible de la consommation du sucre. En outre, le sucre exporté contribuant à la rentrée des dollars dans le bloc sterling, il convient d'en produire le plus possible pour l'exportation. En vue de ces perspectives des dispositions sont prises pour pousser à 725,000 tonnes la production sucrière de l'Union Sud-africaine, but que l'on espère pouvoir atteindre en 1950-51. L'on se souviendra que la plus belle coupe de l'Union fut faite en 1944-45 quand la production atteignit le chiffre record de 164,000 tonnes.

Cuban sale of Molasses to U.K.

The Cuban Institute has reported the sale of blackstrap molasses to the United Kingdom at 18 cents per gallon, with the buyer absorbing the 2.75 per cent export tax, which is equivalent to adding another one half cent to the price. The Institute has also sold to the same purchaser 5 million gallons of alcohol at 70 cents per gallon.

(*Sugar Feb. 1948*).

Alectra Vogelii

Dans un article publié dans le S. A. Sugar Journal de mars 1943 le S/LDR A.E. Haarer décrivant les effets néfastes de l'herbe-feu (*Striga hirsuta*) sur le maïs fait allusion à une plante qui parasite la pistache de manière analogue. Il écrit : "In the lake Province of Tanganyika Territory, another similar weed determined as *Alectra Vogelii* Benth., has exactly the same effect on the groundnut crop. Heaven help the East African groundnut scheme if it gets a hold. Many a native garden is so badly infested that a sowing cannot produce a crop, and a hundred per cent of the groundnut plants are affected. Nothing can destroy the seed in the soil until its tenacious viability is exhausted, and it will not germinate until it comes in contact with a root of its host plant."

Bois et Forêts des Tropiques

Une nouvelle et intéressante revue française trimestrielle, "Bois et Forêts des Tropiques," est publiée depuis juin 1947 sous les auspices du Comité National des Bois Tropicaux. Son siège est à Paris, 16, rue de la Paix.

Les buts que la Revue s'est proposés sont : 1) La diffusion auprès des professionnels et du grand public des connaissances acquises et des résultats des études récentes sur les bois tropicaux ; 2) L'amélioration et l'accroissement de la production de ces bois ; 3) Le développement et l'intensification de leur utilisation.

(*Bulletin Agricole du Congo Belge — Mars 1948*)

Energie Atomique

M. J. O. Cockroft, directeur de l' "Atomic Energy Research Establishment" de Grande-Bretagne a récemment déclaré que la première machine actionnée par l'énergie atomique a été mise en service avec succès. Il ne s'agit jusqu'à présent que d'une installation d'essais de proportions assez modestes, mais on a déjà commencé la construction d'une machine de plus grand modèle.

(*Chimie et Industrie — Janv. 1948*.)

Jubilé Scientifique de M. Auguste Chevalier

Le Jubilé scientifique de M. le Pr. Auguste Chevalier a été célébré à Paris au Muséum National d'Histoire Naturelle le 23 octobre 1947. Au cours d'une réception donnée dans l'après-midi du même jour M. Georges Duhamel improvisa une allocution au cours de laquelle il dit : " Il est des savants dont la pensée est naturellement inaccessible aux hommes de culture moyenne. Tel n'est pas le cas d'Auguste Chevalier. Il a, botaniste infatigable et même aventureux, parcouru le monde entier, et notamment l'Afrique, où il trouve son domaine de prédilection. Il a partout étudié les végétaux, reconnu les uns, décrit les autres, nommé puis observé ceux que les savants ne connaissaient pas encore. Il a rassemblé et bien classé de surprenantes collections de bois. Il a planté des jardins, donné des avis aux agriculteurs, inspiré des réformes, déterminé certains hommes de gouvernement. Il a découvert et signalé des espèces de caféier plus vigoureuses et plus fécondes que les autres, étendu, amélioré la culture des végétaux producteurs de caoutchouc. Il a encore — je ne dirai pas "enfin," car l'énumération des travaux de ce savant occuperait tout un ouvrage — il a découvert des aliments nouveaux pour l'homme et pour l'animal."

(R.B.A. Nov-Dec. 1947)

Le Selenium comme insecticide

Le docteur Hubert Martin, le biochimiste de la station de recherches de l'Université de Bristol à Long Ashton, a fait ressortir le danger qu'entraînait l'emploi du seleniate de soude comme insecticide. Cet insecticide peut causer la stérilité chez les humains aussi bien que chez les animaux et provoque une chute des cheveux et des ongles.

On avait remarqué dans certaines parties des Etats-Unis, où le selenium existe à l'état naturel dans le sol, que le bétail perdait son poil et dépérissait, tandis que les plantes étaient indemnes d'attaques par les insectes. On essaya alors le selenium comme insecticide et de nombreux fleuristes en Angleterre l'emploient comme tel sans se douter de ses propriétés dangereuses.

Des expériences faites à Long Ashton ont démontré que le blé traité au selenium devenait stérile et qu'une poule nourrie de ce blé pondait — mais des œufs clairs seulement.

MICRODOSAGES RAPIDES DE N, P ET K PAR COLORIMÉTRIE PHOTO-ÉLECTRIQUE UTILISÉS A MAURICE POUR LE DIAGNOSTIC FOLIAIRE DE LA CANNE A SUCRE

PIERRE HALAIS

Laboratoire du " Mauritius Sugar Industry Reserve Fund " — Curepipe

Plan du mémoire :

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- II. PRÉLÈVEMENT SYSTÉMATIQUE DES RONDELLES DE FEUILLES.
- III. CLÉ D'INTERPRÉTATION DU DIAGNOSTIC.
- IV. DESCRIPTION DES MICRO-DOSAGES : MATÉRIEL, RÉACTIFS, MODE OPÉRATOIRE ET CALCUL.
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 - (d) Attaque sulfo-oxygénée.
 - (e) Dosage de l'azote par nesslerisation directe.
 - (f) Dosage de l'anhydride phosphorique par œurnéomolybdimétrie.
 - (g) Obtention des cendres sulfatées.
 - (h) Dosage colorimétrique de la potasse par le réactif au dipi-crylamine de lithium.

V. BIBLIOGRAPHIE.

I. CRÉATION D'UN LABORATOIRE SPÉCIALISÉ.

Nous avons publié dans un mémoire (6) paru l'année dernière, les détails relatifs aux méthodes volumétriques propres au dosage de N, P^2O^5 et K^2O dans les matières végétales et applicables au diagnostic foliaire. Ces mêmes méthodes furent largement utilisées au cours des travaux (4,6) que nous avons poursuivis de 1936 à 1946 à la Station de Recherches du

Service de l'Agriculture au Réduit et qui aboutirent à la mise en œuvre du contrôle biochimique (7,8) des fumures dans la culture de la canne à Maurice.

Il ne s'agissait plus dès lors de recherches mais bien de réalisations, entraînant forcément un changement complet dans le choix des méthodes analytiques qui devaient allier, cette fois, la rapidité et le faible coût d'exécution à la précision requise. Tel fut l'objectif du Comité du Fonds de Réserve de l'Industrie Sucrière, lorsqu'il décida de créer un laboratoire spécialisé, doté d'un matériel moderne, capable d'entreprendre chaque année, dans un délai aussi bref que possible, des diagnostics foliaires sur ronde les de feuilles de cannes prélevées systématiquement sur un nombre considérable de champs individuels appartenant aux différentes catégories de planteurs de l'île.

Ce laboratoire est actuellement en plein fonctionnement et plusieurs milliers d'analyses ont été effectuées au cours des derniers mois par un personnel qui s'est adapté rapidement aux techniques nouvelles et à la routine du travail en grande série.

Quant aux avantages pratiques à escompter de la poursuite du contrôle biochimique des cultures de cannes, ils ressortent avec une netteté accrue à mesure que se poursuit le contrôle lui-même. Pour certains planteurs ce sera des dépenses judicieuses à encourir avec la certitude de voir leurs champs rendre davantage, dès qu'ils seront parvenus à combler les déficiences ; pour d'autres, ce sera des économies judicieuses à réaliser sans crainte de voir fléchir leurs rendements culturels, aussi longtemps que le diagnostic persistera à enregistrer des teneurs excédentaires.

II. PRÉLEVEMENT SYSTEMATIQUE DES RONDELLES DE FEUILLES.

La méthode de prélèvement des rondelles de feuilles par poinçonnement au champ et la conservation des échantillons en alvéoles dans des boîtes spéciales en bois, se prêtent fort bien aux conditions qui prévalent sur les plantations et exigent un minimum d'effort de la part des échantillonneurs.

Sans toutefois revenir sur le détail de cette opération (6), il y a lieu de préciser une fois de plus que l'interprétation du diagnostic, voire la réussite même du contrôle biochimique en question, exige de la part du planteur un échantillonnage convenable des feuilles qui gardera sa valeur comparative de champ à champ et d'année en année.

C'est dans ce but qu'il faudra désormais se conformer strictement au mode d'échantillonnage suivant :

- (1) Ne pratiquer le diagnostic que sur les cannes de la variété M 134/82 qui occupe aujourd'hui plus de 80 o/o des plantations de l'île.
- (2) Faire les prélèvements en période de grande végétation, c'est-à-dire pour Maurice, en janvier, février, mars ou avril.
- (3) Se confiner exclusivement aux champs portant des deuxièmes et

des cinquièmes repousses, afin de procéder avec méthode et de pouvoir revenir sur le même champ à intervalles réguliers d'environ trois années.

(4) De façon à s'assurer un diagnostic certain se rapportant à un champ donné, il conviendra de prélever les feuilles à deux reprises : lorsque les repousses seront âgées de 5 mois et de 6 mois. (Il y a lieu à cet égard de faire mention qu'à Maurice les repousses de cannes sont récoltées tous les ans lorsqu'elles ont atteint environ douze mois). Le double échantillonnage est facilité par l'emploi des boîtes à échantillons qui comportent chacune deux rangées de cinq alvéoles, celle de gauche servira au premier prélèvement à l'âge de 5 mois et son pendant de droite au deuxième à 6 mois. On pourra, selon les circonstances, entreprendre l'analyse chimique séparément sur chacun des deux échantillons, ou collectivement sur un mélange à poids égal de ces derniers.

(5) On devra proscrire tout prélèvement sur les cannes qui ne seront pas réellement en pleine végétation, qui souffriront d'une sécheresse passagère, ou qui auront été endommagées par un cyclone récent. Il vaudra mieux en l'occurrence renoncer au diagnostic en attendant la réalisation, au cours de l'année suivante, de conditions plus favorables au prélèvement des feuilles.

(6) C'est la troisième feuille en partant du sommet, celle partiellement déroulée comptant comme la première, qui devra être prélevée sur des tiges à tout venant et réparties sur l'étendue entière du champ à échantillonner. Il est préférable et plus expéditif que les 60 feuilles, qui devront constituer l'échantillon moyen représentatif, soient prélevées par trois ouvriers agricoles différents, l'un traversant le centre, l'autre la partie droite, et le troisième la partie gauche du champ, chacun récoltant vingt feuilles.

(7) Le poinçonnement devra être pratiqué sur un point très localisé de la feuille, sur la partie médiane du parenchyme du limbe, après s'être débarrassé de la nervure.

(8) Le matériel d'échantillonnage comprend :

(a) Des boîtes à échantillons en bois plein de $16 \times 7,5 \times 1,5$ cm, portant deux rangées de cinq alvéoles de 2,5 cm de diamètre et d'un cm de profondeur, munies de deux petites pointes en cuivre pour fixer un obturateur en carton sur les rondelles de feuilles prélevées. Cet obturateur servira d'étiquette sur laquelle seront inscrits la date du prélèvement, le numéro du champ, etc.

(b) Des supports à surface croutchoutée pour ranger les unes sur les autres les parenchymes des feuilles échantillonnées avant de procéder aux poinçonnements collectifs nécessaires.

(c) D'un poinçon tranchant fabriqué à l'aide d'une douille vide de carton en cuivre de 5 mm de diamètre et comptant un manche amovible en bois.

(9) Un échantillon d'environ 240 rondelles de 5 mm suffit amplement pour l'analyse chimique effectuée au moyen des micro-méthodes décrites dans ce mémoire.

III. CLÉ D'INTERPRÉTATION DU DIAGNOSTIC.

Méthode du poinçonnement des feuilles sur des repousses de la variété M 134/32 âgées de 5 à 6 mois, échantillonnées convenablement :

Diagnosics Foliaires o/o Matière Sèche

Teneur des feuilles en éléments nutritifs :	Abr.	Azote N	Phosphate P ² O ⁵	Potasse K ² O	Apports d'engrais recommandés pour l'année culturale suivante :
—	—	—	—	—	—
EXCÉDENTAIRE	E	> 1.85	> 0.55	> 1.75	REDUCTION
OPTIMALE	O	1.85—1.66	0.55—0.46	1.75—1.26	MAINTIEN
DEFICITAIRE (assez)	d	1.65—1.45	0.45—0.35	1.25—0.75	AUGMENTATION (légère)
DEFICITAIRE (franchement)	D	< 1.45	< 0.35	< 0.75	AUGMENTATION (notable)

Cette clé pourrait être modifiée à l'occasion au fur et à mesure que s'accumuleront les données comparatives plus nombreuses entre diagnostics foliaires d'une part et résultats d'essais aux champs avec la canne sur engrais azotés, phosphatés et potassiques, de l'autre.

Il convient de noter à propos de l'interprétation, que les teneurs des feuilles en azote, phosphate ou potasse, révélées par diagnostic, ne sont pas en relation directe avec le rendement cultural que l'on constate au champ chaque année, elles sont cependant en relation étroite avec la possibilité d'augmenter ce rendement — quelle que soit sa valeur absolue — par apport additionnel sous forme d'engrais, de l'élément ou des éléments nutritifs qui se trouvent en déficit dans la feuille, comparativement aux teneurs optimales.

IV. DESCRIPTION DES MICRO-DOSAGES : MATÉRIEL, RÉ-ACTIFS, MODE OPÉRATOIRE ET CALCUL.

(a) Introduction sur le choix des techniques :

Après l'étude de la littérature relative aux microdosages colorimétriques de N, P et K dans les feuilles, nous nous sommes servis comme point de départ des techniques décrites récemment par Robert H. Cotton (5). La mise au point de ces techniques, en ce qui concerne l'analyse des feuilles, a été faite par ce dernier dans le laboratoire de la nutrition végétale du " Pennsylvania State College, U.S.A. ", que dirige le Professeur Walter Thomas, spécialiste universellement connu pour ses travaux sur le diagnostic foliaire.

Etant donné que le laboratoire de l'Industrie Sucrière à Maurice devait fonctionner à un rythme élevé, l'emploi exclusif du chauffage électrique pour les attaques, évaporations et calcinations était tout indiqué

pour remplacer le chauffage au gaz employé par Cotton. Il y avait lieu, en outre, d'agencer le travail de telle sorte que l'avantage des boîtes à alvéoles, comportant deux rangées de cinq échantillons prélevés au champ et numérotés systématiquement, soit maintenu tout au long des manipulations au laboratoire en reliant fioles, creusets, flacons et tubes de colorimètre par batteries dont les unités occuperaient les mêmes positions que les échantillons dans les alvéoles. On se rend compte que ce système "décimal" d'agencement au laboratoire offre de gros avantages lorsqu'il s'agit de grandes séries d'analyses.

L'attaque sulfo-oxygénée nécessaire au dosage de l'azote et de l'anhydride phosphorique, peut être menée rapidement et avec sécurité sur des plaques chauffantes électriques à réglage continu, après ajustement convenable de la température en surface et standardisation de la durée de chaque opération.

Le dosage colorimétrique de l'azote par nesslerisation directe suivant la technique de Lindner (3) est très satisfaisant ; il convient à cet égard d'insister sur la nécessité de bien agiter la solution dans le tube du colorimètre entre l'addition de chaque goutte de réactif nessler.

Le dosage de l'anhydride phosphorique par colorimétrie selon le procédé au réactif de Fisk-Subbarow (technique de King) est aussi parfaitement au point pour l'analyse des feuilles. Nous avons cru nécessaire cependant de substituer le molybdate de soude au molybdate d'ammoniaque utilisé généralement, afin de prévenir tout danger de contamination lors du dosage de l'azote. Il y a lieu, de plus, d'attirer l'attention sur la nécessité d'ajouter le réactif réducteur aussi vite que possible après l'addition de la solution molybdique.

Lorsqu'on dispose d'un moufle électrique muni d'un pyromètre ainsi que de creusets en silice "Vycor" en quantité suffisante, l'emploi de la méthode colorimétrique d'Amdur pour le dosage de la potasse à l'aide du réactif au dipicrylamine de lithium mis directement sur les cendres sulfatées, obtenues sur une prise d'essai séparée de rondelles de feuilles, présente des avantages multiples sur le mode opératoire décrit par Cotton.

Dès le début du fonctionnement du laboratoire, il fut décidé de procéder chaque jour, concurremment aux essais sur rondelles de feuilles, à un essai à blanc sur saccharose extra-pur ainsi qu'à un essai de contrôle sur saccharose additionné d'une solution titrée. Celle-ci devra être de même concentration en N et P_2O_5 , par rapport à la matière sèche que l'optimum alimentaire souhaité dans l'interprétation du diagnostic foliaire de la canne. On procédera de même pour le dosage de la potasse en évaporant directement une solution titrée de concentration requise en potasse. L'essai à blanc sert à éliminer des résultats la coloration propre des réactifs utilisés et l'essai de contrôle est nécessaire pour trouver par calcul les teneurs en éléments nutritifs des feuilles examinées. Cette manière de procéder, tout au moins pour le cas qui nous intéresse — sur une même matière végétale de concentration relativement peu variable en N,

P_2O_5 et K_2O — offre plus de sécurité que l'emploi de graphiques représentant une fois pour toutes la relation entre les lectures du colorimètre photo-électrique et les concentrations en éléments nutritifs de solutions de contrôle différentes.

On pourra se dispenser de l'emploi d'eau distillée pour les dilutions, la même eau de conduite pouvant servir à la fois pour les essais sur feuilles, l'essai de contrôle et l'essai à blanc.

Nous utilisons pour les comparaisons, le colorimètre photo-électrique "Lumetron 400 GB" fonctionnant sur accumulateur. Cet appareil, fort simple à manier, fournit rapidement des lectures d'une grande régularité. Toutes les lectures sont faites sur l'échelle de la densité optique, afin de tirer parti de la relation linéaire entre cette dernière et les concentrations utiles en N, P_2O_5 et K_2O , facilitant ainsi les calculs en fin d'analyse par l'adoption de coefficients.

Les fabricants de colorimètre livrent des tubes de comparaisons tout calibrés. Il sera bon cependant de vérifier les tubes de 22 mm utilisés pour le dosage de l'azote qui exige une plus grande précision, en comparant entre elles les lectures d'une même solution très diluée de bichromate de potasse (filtre 530). On devra éliminer les tubes fournissant des écarts trop prononcés et inscrire sur les autres la correction trouvée.

La verrerie utilisée au laboratoire se compose presque exclusivement de Pyrex et les produits chimiques employés appartiennent, lorsqu'il le faut, au grade spécial pour micro-analyse — "Baker's Analysed".

(b) Dessication.

Matériel :

Étuve électrique bien ventilée (Precision Freas, type A).

Dessicateurs étanches au chlorure de calcium.

Mode opératoire :

Après avoir numéroté systématiquement les deux rangées de cinq alvéoles des boîtes contenant les échantillons et avoir inscrit dans un registre la provenance, la date de prélèvement, le numéro du champ, etc., que porte chacun des obturateurs en carton, on enlèvera ces derniers et on placera les boîtes dans une étuve électrique réglée à 105-110 °C. Après avoir maintenu ces dernières à cette température pendant environ quatre heures, on les laissera refroidir complètement dans un dessicateur étanche.

(c) Prise d'essai.

Matériel :

Micro-balance à torsion (0 à 500 mg., Roller Smith).

Mode opératoire :

(1) Peser rapidement une première prise d'essai de 50 mg de rondelles

sèches sur une micro-balance à torsion et les introduire en fiole conique de 50 cm³ reliée en batteries de deux rangées de cinq, numérotées systématiquement. Ce prélèvement sert à l'attaque sulfo oxygénée, prélude aux dosages de l'azote et de l'anhydride phosphorique.

(2) Poser rapidement une deuxième prise d'essai de 50 mg de rondelles sèches et les introduire en creuset de 20 cm³ en silice — "Vycor" — relié en batteries de deux rangées de cinq, numérotées systématiquement. Le dispositif utilisé devra être ininflammable. Ce prélèvement sert à l'obtention des cendres sulfatées, prélude au dosage de la potasse.

(d) *Attaque sulfo-oxygénée.*

Matériel :

Fioles coniques de 50 cm³.

Dispositif pour relier ces fioles en batterie de 2 rangées de cinq.

Pipette de 10 cm³ graduée en 1 cm³.

Plaques chauffantes électriques à réglage continu (Lindberg II-1).

Thermomètres pour plaques chauffantes.

Petits entonnoirs pour fioles.

Pipette de 50 cm³ à remplissage automatique de Dafert.

Bouchons de caoutchouc pour fioles.

Réactifs :

Acide sulfurique d. 1,84 (Baker's analysed)... .. réactif A 1.

Eau oxygénée à 30 v/o (" ")... .. " A 2.

Saccharose extra pur (" ")... .. " C 1.

Solution synthétique de contrôle NP :— " C 2.

Sulfate d'ammoniaque pur et sec 0,820 g.

Phosphate bisodique anhydre (Taylor) 0,100 g.

Acide sulfurique d. 1,84 20 cm³

Eau distillée q.s.p. 1000 cm³

Cette solution contient par cm³ 0,175 mg d'azote, et 0,05 mg de P²O⁵ ; 5 cm³ employés pour l'essai de contrôle apportent 0,875 mg d'azote et 0,25 mg de P O⁵.

Mode opératoire :

Ajouter sur la prise d'essai de 50 mg de rondelles sèches contenues en fioles de 50, un cm³ d'acide sulfurique (réactif A 1) à l'aide d'une pipette de 10 cm³ graduée en 1 cm³.

Concurremment à chaque série d'analyses sur feuilles préparer un essai à blanc (Essai 0) sur 50 mg de saccharose (réactif C 1), et un essai de contrôle (essai C) sur 50 mg de saccharose et 5 cm³ de solution de contrôle (réactif C 2) Dans ce dernier cas, évaporer à l'étuve avant d'ajouter 0,9 cm³ d'acide sulfurique (réactif A 1) et de procéder à l'attaque sulfo-oxygénée.

Porter les batteries de fioles sur plaque chauffante électrique réglée à 190-200 °C en surface et les y maintenir pendant 10 minutes. Retirer les batteries et laisser refroidir spontanément.

Ajouter à l'aide d'une pipette, 5 gouttes, soit 0,25 cm³, d'eau oxygénée à 30 o/o (réactif A 2) et placer un petit entonnoir sur les fioles. Porter les batteries sur une deuxième plaque chauffante réglée à 120-130 °C et les y maintenir pendant 10 minutes. Reporter aussitôt sur une troisième plaque à 300-325 °C et les y laisser durant 3 minutes. Retirer les batteries et laisser refroidir une quinzaine de minutes.

Ajouter de nouveau 3 gouttes d'eau oxygénée. Porter sur plaque à 120-130 °C et maintenir 10 minutes. Reporter sur plaque à 300-325 °C et maintenir 3 minutes. Retirer les batteries et laisser refroidir.

Ajouter encore 2 gouttes d'eau oxygénée et procéder au chauffage, etc., comme décrit précédemment, après avoir enlevé le petit entonnoir de sur les fioles, afin d'éliminer toute trace d'eau oxygénée. Retirer les batteries et laisser refroidir complètement.

La solution d'attaque doit être parfaitement limpide à ce stade, sinon, recommencer ce dernier traitement — une ou deux gouttes d'eau oxygénée additionnelles suffisent généralement.

Ajouter au liquide contenu au fond des fioles refroidies 50 cm³ d'eau à l'aide d'une pipette automatique. Boucher les fioles et agiter les batteries par retournement afin de rendre la solution d'attaque parfaitement homogène.

(e) *Dosage de l'azote par nesslerisation directe.*

Matériel :

Pipettes de 5 cm³ et de 10 cm³.
 Flacons de 100 cm³ reliés en batteries de 2 rangées de cinq.
 Bouchons de caoutchouc pour ces flacons.
 Pipettes de 10 cm³ graduées en 1 cm³.
 Pipettes de 50 cm³ à remplissage automatique de Dufort.
 Burette compte-gouttes pour réactif Nessler.
 Tubes calibrés de colorimètre, 22 mm de diamètre extérieur.
 Supports pour 2 rangées de 5 tubes.
 Colorimètre photo-électrique (Lumetron, Mod. 400 GB).
 Entre vert-bleu à transmission maxima de 490 millimicrons.
 Accumulateur ferro-nickel de 6 volts et 95 amp. (Alkum NK).

Réactifs :

Liquueur 2, 5 normale de soude caustique ...	...	réactif N 1.
NaOH	100 g	
Eau distillée q.s.p. ...	1000 cm ³	
Solution aqueuse de silicate de soude ...	...	réactif N. 2.
Na ² SiO ³ . 9H ² O	100 g	
Eau distillée q.s.p. ...	1000 cm ³	
Réactif Nessler (Vanselow 1940) (1) ...	...	réactif N 3.

Disoudre 45,5 g d'iode mercurique et 34,9 g d'iode de potassium dans le minimum d'eau nécessaire, ajouter 112 g d'hydrate de potassium et diluer à un litre avec de l'eau distillée. Laisser reposer quelques jours avant de décantier la liqueur qui surmonte le dépôt. Conserver le réactif limpide en flacon jaune.

Mode opératoire :

Prélever 5 cm³ de la solution d'attaque sulfo-oxygénée sur rondelles de feuilles ainsi que sur l'essai à blanc (essai 0) et sur l'essai de contrôle (essai C) et les introduire dans des flacons de 100 cm³ reliés en batteries de deux rangées de cinq, numérotées systématiquement. Ajouter 1 cm³ de liqueur de soude caustique (réactif N 1), agiter, puis ajouter 1 cm³ de solution desilicate de soude (réactif N 2), et agiter à nouveau. Ces deux additions se font au moyen de pipettes de 10 cm³ graduées en 1 cm³. Ajouter finalement 50 cm³ d'eau à l'aide d'une pipette à remplissage automatique. Boucher et agiter les batteries par retournement pour bien homogénéiser le liquide.

Prélever 10 cm³ de cette solution diluée et les introduire en un tube calibré de colorimètre de 22 mm de diamètre extérieur, placé sur un support de deux rangées de cinq, numérotées systématiquement.

Ajouter 6 gouttes (0,3 cm³) de réactif Nessler en agitant vivement le tube entre l'addition de chaque goutte. Abandonner pendant 30 minutes avant de procéder à la comparaison colorimétrique.

Passer les tubes les uns après les autres au colorimètre photo-électrique après avoir ajusté la densité optique à zéro avec le tube contenant l'essai à blanc (essai 0N). S'assurer au cours d'une série de dosages, à chaque intervalle de cinq comparaisons, que l'essai à blanc lise exactement zéro. Dans le cas contraire régler l'appareil à nouveau et vérifier les 5 dernières lectures.

Calcul :

L'essai de contrôle (essai CN) correspond à 1,75 o/o d'azote sur la matière sèche, soit 0,875 mg d'azote pour une prise d'essai de 50 mg de feuilles.

Exemple :

Lecture de l'essai de contrôle = 10,0 de densité optique \times 100

„ „ sur feuilles = 9,8 „ „

Azote o/o matière sèche des feuilles = $\frac{1,75 \times 9,8}{10,0} = 1,73.$

(f) Dosage de l'anhydride phosphorique par colorimétrie.

Matériel :

Pipettes de 5 cm³.

Tubes calibrés de colorimètre, de 18 mm de diamètre extérieur.

Supports pour deux rangées de cinq tubes.

Pipettes de 10 cm³ graduées en 1 cm³.

Microburette de Koch pour réactif sulfonique.

Colorimètre, etc., comme pour le dosage de l'azote.

Filtre rouge à transmission maxima de 650 millimicrons.

Réactifs :

Acide sulfurique dilué : réactif P 1.

Acide sulfurique pur d. 1,84 ... 100 cm³

Eau distillée q.s.p. ... 1000 cm³

Solution aqueuse de molybdate de soude : réactif P 2.

Na² MoO⁴. 2 H²O ... 17 g

Eau distillée q.s.p. ... 250 cm³

A préparer tous les quinze jours.

Réactif à l'acide sulfonique (King 1932) : réactif P 3.

1-amino-2-naphtol-4-acide sulfonique ... 0,25 g

Bisulfite de soude (Méta) ... 15 g

Sulfite de soude en cristaux ... 3 g

Eau distillée q.s.p. ... 125 cm³

Filtrer. A préparer tous les quinze jours.

Mode opératoire :

Prélever 5 cm³ de la solution d'attaque sulfo-oxygénée sur rondelles de feuilles ainsi que sur l'essai à blanc (essai 0) et sur l'essai de contrôle (essai C) et les introduire en tubes calibrés de colorimètre de 18 mm de diamètre extérieur, placés en support de deux rangées de cinq numérotées systématiquement. Ajouter 1 cm³ d'acide sulfurique dilué (réactif P 1) et agiter, puis 1 cm³ de solution molybdique (réactif P 2) et agiter de nouveau. Ces additions seront faites à l'aide de pipettes de 10 cm³ graduées en 1 cm³. Ajouter dans un bref délai 0,25 cm³ de réactif sulfonique (réactif P 3) contenu dans une micro-burette de Koch. Agiter encore une fois avant d'abandonner 30 minutes ; après quoi, procéder à la comparaison colorimétrique exactement comme pour l'azote mais en se servant du filtre rouge (650 millimicrons) et en ajustant la densité optique à zéro avec le tube contenant l'essai à blanc (essai 0 P) pour l'anhydride phosphorique.

Calcul :

L'essai de contrôle (essai C P) correspond à 0,50 o/o P² O⁵ sur la matière sèche, soit 0,25 mg de P² O⁵ pour une prise d'essai de 50 mg de feuilles sèches.

Exemple :

Lecture de l'essai de contrôle = 21,0 de densité optique ($\times 100$)

„ „ „ sur feuilles = 23,5 „ „ „ „

P² O⁶ o/o matière sèche des feuilles = $\frac{0,50 \times 23,5}{21,0} = 0,56$.

(g) Obtention des cendres sulfatées.**Matériel :**

Creusets de 20 cm³ en silice — “ Vycor ” de Corning —.

Supports ininflammables pour relier les creusets en batteries de deux rangées de cinq.

Four électrique (Lindberg B6 avec contrôle et pyromètre P2L2).

Étuve électrique (Precision Freas, type A).

Plaque chauffante (Lindberg H 1)

Réactifs :

Acide sulfurique dilué : réactif K 1.

Acide sulfurique d. 1,84 ... 100 cm³

Eau distillée q.s.p. ... 1000 cm³

Mode opératoire :

Ajouter 10 gouttes (0,5 cm³) d'acide sulfurique dilué (réactif K 1) sur la prise d'essai de 50 mg de feuilles sèches contenues dans des creusets de 20 cm³ en silice “Vycor”. Évaporer une heure à l'étuve réglée à 105-110 °C, puis porter sur plaque chauffante électrique réglée à 300-325 °C jusqu'à cessation des fumées blanches. Introduire encore chaud dans un moufle électrique porté préalablement au rouge sombre, 700 °C ; enlever les batteries de creusets après une demi-heure de calcination à cette température.

(h) Dosage colorimétrique de la potasse par le réactif au dipicrylaminé de lithium.**Matériel :**

Micro-burette de Koch pour le réactif au dipicrylaminé.

Micro-pipettes de 0,4 cm³ — pour analyse de sarg —.

Rondelles de papier à filtrer et bagues de caoutchouc assorties aux micro-pipettes.

Flacons de 150 cm³ et bouchons de caoutchouc.

Supports pour relier ces flacons en batteries de deux rangées de cinq.

Pipette de 100 cm³ à remplissage automatique de Dafert.

Pipettes de 10 cm³.

Tubes calibrés de colorimètre de 18 mm de diamètre extérieur.

Support pour 2 rangées de cinq tubes.

Colorimètre, etc, comme pour le dosage de l'azote.
Filtre vert-bien (490 millimicrons).

Réactifs :

Solution synthétique de contrôle K : ... réactif C 3.

Sulfate de potassium pur et sec ... 2,775 g

Eau distillée q.s.p. ... 1000 cm³

Cette solution contient par cm³ 0,150 mg de K²O, et cinq cm³ employés pour l'essai de contrôle apportent 0,75 mg de K²O.

Réactif au dipicrylamine de lithium (Andur 1940) (2) : réactif K 2

Carbonate de lithium ... 1,1 g

Dipicrylamine (Hexa-nitro-diphenylamine) ... 6 g

Eau distillée ... 250 cm³

Chauffer le mélange à 50 °C et abandonner pendant 24 heures. Filtrer et amener le volume du filtrat à 1000 cm³ avec l'eau distillée. Chauffer à nouveau à 50 °C et ajouter assez de cristaux humides de dipicrylamine de potassium pour qu'il en reste un excès. Ne plus filtrer le réactif, s'en servir après décantation au fur et à mesure des besoins.— On prépare le dipicrylamine de potassium humide en mélangeant 20 cm³ d'une solution de sulfate de potasse (10 g/litre) à 50 cm³ d'une solution de carbonate de lithium (3,6 g/litre) additionnés de 1 g de dipicrylamine. Après repos d'une heure, laver le précipité par décantation à deux reprises avec de l'eau distillée avant d'en employer pour saturer le réactif.

Mode opératoire :

Ajouter 2 cm³ du réactif au dipicrylamine (réactif K 2) mesurés exactement à l'aide d'une microburette sur les cendres sulfatées refroidies contenues dans les creusets. Remuer et abandonner pendant au moins trois heures. Pour chaque série de dosages sur feuilles procéder concurremment à un essai de contrôle sur 5 cm³ de solution synthétique (réactif C 3) évaporés préalablement à l'étuve dans un bécher de 30 cm³.

La précipitation achevée, prélever 0,4 cm³ du liquide surnageant à l'aide d'une micropipette sèche, dont on se sert pour l'analyse du sang, munie à son extrémité d'une rondelle de papier à filtrer retenue par une bague de caoutchouc.— En préparant pour l'emploi la micropipette, il convient de s'assurer qu'elle laisse passer suffisamment d'air à vide pour faciliter le remplissage par succion.— Le remplissage terminé, enlever le papier à filtrer à l'aide d'une pincette afin de permettre le jaugeage subséquent du liquide prélevé. Il est loisible, afin d'éviter le séchage peu commode des micropipettes, de les laver avant emploi dans une solution de réactif au dipicrylamine (réactif K 2) dilué à moitié.

Introduire la micropipette et son contenu dans un flacon de 150 cm³ renfermant 100 cm³ d'eau mesurés à l'aide d'une pipette automatique. Ces flacons seront reliés en batteries de deux rangées de cinq numérotées systé-

matiquement. Après avoir élevé les micropipettes, on bouche les flacons et l'on rend le liquide homogène par retournement des batteries.

On introduit une dizaine de cm^3 de la solution colorée diluée dans des tubes calibrés de colorimètre de 18 mm de diamètre extérieur, placés dans un support en deux rangées de cinq numérotées systématiquement.

On procède à la comparaison dans le colorimètre photo-électrique comme pour le dosage d'azote avec le filtre vert-bleu (490 millimicrons). Un tube calibré renfermant de l'eau distillée servira à ajuster la densité optique à zéro avant de faire passer les autres tubes au colorimètre. En sus de l'essai de contrôle (essai C K) sur 0,75 mg de K_2O , il est nécessaire de procéder à un essai sur 0,4 cm^3 du même réactif au dipicrylamine utilisé (réactif K 2), additionné de 100 cm^3 d'eau.

Calcul :

L'essai de contrôle (essai C K) correspond à 1,50 o/o K_2O sur la matière sèche, soit 0,75 mg K_2O pour une prise d'essai de 50 mg de feuilles.

Exemple :

Lecture du réactif dilué K 2 = 36,0 de densité optique ($\times 100$)

„ de l'essai de contrôle = 19,5 „ „

„ „ sur feuilles = 18,0 „ „

$$\text{K}_2\text{O o/o matière sèche des feuilles} = \frac{1,50 \times (36,0 - 18,0)}{(36,0 - 19,5)} \\ = 1,63.$$

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SYNTHETIC INSECTICIDES AND MALARIA

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For nearly 50 years entomologists, malariologists and sanitarians in many parts of the world have waged war with totally inadequate weapons against mosquitoes responsible for the transmission of malaria and other serious diseases. By intensive studies and the application of a variety of measures, usually laborious and costly, they have achieved notable successes in many places. But progress has been slow: and until the last few years there were few grounds for hope that we could accelerate that progress to any appreciable degree.

In 1942, however, there arrived in Britain and the United States from Switzerland, small amounts of a synthetic compound called Dichlorodiphenyl-trichloroethane (D.D.T.). Swiss scientists had shown that this substance had quite remarkable insecticidal properties against certain insects with which it was brought into contact. It was very quickly tested by British and American scientists against mosquitoes. Results were very promising and great efforts were made on both sides of the Atlantic to produce the material in quantity for use in malarious theatres of war in the Pacific, Burma, India, Africa and Italy. One of the first large field applications of D.D.T. was for the control of louse-borne typhus in Italy and the Middle East. For this purpose it was blown as a dust inside the clothing of thousands of people. The effect of this measure on the incidence of typhus was striking. As a dust and later as a solution in kerosene it was applied on a large scale by military authorities in Italy, Middle East, Burma and the Pacific for the control of mosquitoes and malaria in camps and in infested jungle where troops had to live and fight. It was sprayed on water as a larvicide and to the jungle itself to kill adult mosquitoes. All kinds of spraying apparatus were used including specially equipped aircraft that could treat very large areas of otherwise inaccessible country in a short time. Results were good where the work was done intelligently and thoroughly; but as may be imagined such emergency operations were very costly in material and in effort.

About the time of the first trials of D.D.T. in Britain, in 1942, the chemists of Imperial Chemical Industries produced another remarkable insecticide known as Benzene Hexachloride (B.H.C.). This exhibited even greater toxic properties than D.D.T. to many insects, though it was more volatile and its toxicity not so lasting as that of D.D.T. The Insecticide Panel set up by the government to promote production of useful

insecticides for the use of the military forces decided, however, to devote all available energies and resources to the study and production of D.D.T. rather than to spread effort over a larger field. Benzene Hexachloride, therefore, could receive relatively little attention until after the cessation of hostilities.

During the last two or three years American scientists have pursued this line of research and have produced several other synthetic insecticides. These, of which the best known are Chlordane and Toxophene, are still undergoing their preliminary tests. We have not yet been able to test them because of exchange difficulties, but from information provided by our American colleagues they may well prove to be of great value perhaps in circumstances unsuitable for D.D.T. and B.H.C.

I should point out here that all these insecticides are toxic to insects on contact only. Unlike the older insecticides such as arsenic or nicotine, they need not be eaten by, or applied on, the insects against which they are directed. It is usually sufficient that the insects make contact with a light deposit of the insecticide, by walking or standing on it or by collecting small air-borne particles during flight. Pyrethrum and derris have a similar action, but their toxic properties do not last more than a day or two, and since they are of vegetable origin they are not easily produced in very large quantities.

It will be realised from the above that during the period of hostilities not very much could be done towards the development of D.D.T. for civilian use. Fully alive to its potentialities as a weapon for use against insect vectors of disease and pests of crops in tropical and subtropical colonies the Research Department of the Colonial Office managed to obtain small amounts for experimental purposes in various territories and in 1944 sufficient was obtained to warrant the initiation of a fairly large experiment against malaria. With this I was closely concerned.

British Guiana was chosen for this first experiment. It is a large country near the equator with a population of about 340,000 of West African and East Indian descent, most of whom live on the very low flat alluvial coast belt. Much of this coast belt is below sea level. It is drained by miles of canals and many pumping stations and protected by a sea-wall. Sugar is the main crop, as it is here. It is irrigated by more miles of canals that bring fresh water from catchment areas a few miles inland. There are extensive swamps in which cattle "graze" up to their necks in water. Coast Belt rainfall averages about 90-100 inches a year; humidities are high, and temperatures are fairly high. Houses are almost entirely of wood, and they are constructed on wood piles from 4' to 10' high. Briefly, British Guiana provides ideal conditions for some of the mosquitoes with which we are most concerned — those responsible for human infections.

The malaria carrier is *Anopheles darlingi*. It breeds prolifically in the miles of canals and drains and the extensive swamps. It is very like *Anopheles gambiae* of Mauritius in that it enters houses in large numbers. This species is also the chief carrier of filariasis which is very prevalent in certain areas, — though it has a good supporter in another mosquito, *Culex fatigans* which breeds in enormous numbers in very stagnant water and in pit latrines. The third important mosquito is *Aedes aegypti*, the carrier of Yellow Fever. This mosquito is also very common and its control in Georgetown, the capital, which experienced an outbreak of Yellow Fever some years ago, has been a very costly effort. Malaria is, — or perhaps I should now say "was" — the country's biggest problem. Except at the far eastern end of the coast belt, its incidence was of about the same order as it is in the low areas of Mauritius. Spleen and parasite rates of from 50 o/o to 80 o/o were common in villages.

We selected for our first experiments two sugar estates and an area occupied by small producers of a variety of crops including rice. Two of these experiments were designed to provide studies on the behaviour of mosquitoes in houses treated with D.D.T., and on the effect of a small variety of different D.D.T. preparations. The third, conducted on one of the sugar estates (Mon Repos), was planned in such a way that results would indicate the effect of D.D.T. on malaria.

Little investigation of D.D.T. preparations other than solutions in kerosene had been possible. We, therefore, used a 5 o/o solution in kerosene for our estate labour lines. Briefly, the results were as follows:—

- (I) One application of 5 o/o D.D.T. in kerosene to the inside surfaces of walls and roofs, at a dosage of approximately 100 mgms. per square foot, produced an immediate reduction on total mosquito populations and of *A. darlingi*, in treated houses, as measured by routine morning catches, by over 98 o/o.
- (II) Ten months after this single application of 5 o/o D.D.T. in kerosene, total mosquito populations of treated houses and numbers of *A. darlingi* were still reduced by over 92 o/o.
- (III) The treatment was effective against a variety of species of mosquitoes that entered houses to feed upon people, but it was slightly less effective against *Culex fatigans* than against *A. darlingi*.
- (IV) At Mon Repos estate amongst the people whose houses were treated, no cases of malaria were reported for about eight months after this first application and spleen rates were reduced from 70 to 44 and parasite rates from 42 to 20 in five months.

From the experiment in the area of small producers, which included

a few houses with mud walls, we learned several things of value to our future work, the most important being the absorption of solutions and emulsions by the dried mud of walls.

These experiments were merely the initiation of insecticide applications. They have since been extended very greatly by Dr. Giglioli and his staff, so that the work has developed into an accepted method of control of malaria.

Dr. Giglioli has reported that about 200,000 of the population are under partial or complete protection of D.D.T. house-spraying and that the effect on malaria is quite beyond expectation. In one heavily infected village spleen rates dropped from 60 o/o to 18 o/o in a year and infantile mortality from 350 per thousand to 96.

Our experience in British Guiana indicated quite clearly that it was urgently desirable to extend our efforts to other territories with different conditions. Uganda was selected for the next series of investigations. Uganda is very different from British Guiana in nearly every way. Rain-fall and humidities are much lower, temperatures are about the same, and topography is entirely different. There are no canals and drains, though there are swamps and streams and temporary surface pools during rains providing adequate facilities for large numbers of mosquitoes, including *A. gambiae* and *A. funestus*. And, most important feature, nearly all rural houses have mud walls and thatched roofs. There we started two fairly large field experiments designed to indicate the effect of a variety of D.D.T. and Benzene Hexachloride formulations on malaria in rural areas.

In the first of these, conducted outside Jinja, on the north shore of Lake Victoria, about 1,500 houses, mostly of mud walls and grass thatch roofs, have had their inner wall and roof surfaces treated with a 5 o/o solution of D.D.T. in Diesoline at a dosage of approximately 200 milligrams per square foot. Four applications have been given over a period of about 18 months, including two wet seasons. In this experiment we have had the valuable co-operation of Drs. D. & M. Bagster Wilson, malariologists of wide experience in East Africa.

Our suspicions in British Guiana that mud walls absorbed a great deal of the insecticide-oil solution put on them have been confirmed. We know now that as much as 85 o/o of our total dosage may be lost as a contact insecticide in this way, as soon as it is applied. This leaves a relatively small amount on the wall surfaces to make contact with mosquitoes that sit on them before or after feeding. But we wished to ascertain whether or not repeated applications over a period will get over this difficulty. It was just possible for instance, that the mud would become thoroughly impregnated and that the normal surface erosion of the dried

mud would expose greater concentrations of the insecticide. Apparently this did not happen. Though the applications reduced very appreciably the numbers of mosquitoes found in huts, including *A. gambiae*, *A. funestus*, and a third malaria vector, *A. moucheti*, they have had little, if any, effect on malaria as may be seen by the figures of spleen and parasite rates in table No. 1.

TABLE I

Jinja ; parasites

Ages of Children	Nov. 1945	June 1946	Aug. 1946	Nov. 1946	
0 — 1	55 o/o	55 o/o	55 o/o	59 o/o	} Treated Area.
1 — 5	90	74	87	90	
6 — 10	78	63	83	81	
0 — 1	66 o/o	20 o/o	71 o/o	—	} Untreated Area.
1 — 5	100	71	96	88 o/o	
6 — 10	88	76	84	85	

For the second field experiment we chose a rural area on the north-west side of Lake Victoria with a population of 5,400 and about 2,200 dwellings. This area has seven administrative districts. Six of these were selected for treatment and the seventh was used as control. Houses were again mostly of mud walls and thatch roof, with an average of 3-4 small rooms. The following preparations were applied to internal surfaces of walls and roofs.

District	Preparations used.
Mumyuka	5 o/o D.D.T. in Diesoline on roofs & walls.
Sabawali	5 o/o B.H.C. " "
Matuba II	5 o/o B.H.C. wettable powder in water on roofs & walls.
Matuba III	5 o/o D.D.T. in kerosene and cotton seed oil on roofs & walls.
Musale	5 o/o D.D.T. in Diesoline on walls only
Sabagabo	5 o/o D.D.T. " " roofs only

Three applications of each were made over a period of about 15 months, which included two wet seasons.

The apparent effects of all treatments on the female anopheline mosquito populations of houses, as measured by the usual "flit-catching" method, were striking. They are shown in Table 2.

TABLE II

Captures of A. gambiae and A. funestus females in 4-weekly periods.

Week ending	Mumyuka	Musala	Matuba II	Matuba III	Sabagabo	Sabawali	Sabadu (Control)
30. 3.46	114	—	126	36	1	19	14
27. 4.46	151	1	176	144	12	7	11
25. 5.46	136	59	478	343	181	48	32
22. 6.46	—	75	1st spray	—	164	1st spray	38
1st spraying							
6. 7.46	1	1st 1pray	8	1st spray	1st spray	2	—
3. 8.46	1	0	2	2	1	1	14
31. 8.46	0	0	1	1	0	1	4
28. 9.46	1	1	5	3	2	1	3
26. 10.46	3	7	10	9	3	5	29
16. 11.46	3	2nd spray	2nd spray	2nd spray	2nd spray	2nd spray	52
2nd spraying							
4. 1.47	0	1	2	0	1	0	51
1. 2.47	1	0	2	0	0	1	16
1. 3.47	0	0	0	0	2	1	6
12. 4.47	0	0	3rd spray	0	36	0	3
3rd spraying							
10. 5.47	0	3rd spray	0	0	0	1	12
7. 6.47	0	0	11	1	9	9	59
5. 7.47	0	4	4	0	4	4	46
2. 8.47	0	0	3	0	1	2	4
30. 8.47	0	0	3	0	0	2	5

Note : 18 houses were sampled weekly up to 28.9.46 and thereafter 30.

Effects on the malaria parasite rates, however, were very different (see Table 3). It seems that the applications of D.D.T. solutions may have checked the seasonal rise of malaria in both wet seasons and that the Benzene Hexachloride applications were followed by appreciable reductions of the parasite rates during both wet seasons. But it is considered that our apparent results though very promising are not yet significant and the experiment must continue for at least another wet season.

TABLE III

Parasite rates (totals) in Children 1—10 years

District	May 1946	August 1946	January 1947	June 1947
Mumyuka	31	28	38	30
Musale	35	33	38	41
Matuba II	55	27	34	29
Matuba III	51	50	49	36
Sabagabo	27	44	33	31
Sabawali	35	23	32	23
Sabadu	—	—	—	—
(Control)	20	30	37	42

We have been associated with a third field experiment of this kind, conducted by Dr. P. C. Garnham and his staff, in the highlands of Kenya. Here at 6,000 feet malaria is sharply seasonal. *A. funestus* occurs in streams and shaded swamps but *A. gambiae*, increasing rapidly during the months of April to June, is the chief vector. Occasional epidemics of severe virulence with resulting high death-rates sweep the area.

The Africans concerned are essentially stock-owners, living in round mud-walled and grass-thatched houses each with an upper-storey in which are stored food grains and implements.

The aim here, as in the Jinja experiment, was to treat the internal surfaces of houses with a 5 o/o D.D.T. — Power Kerosene solution at an approximate dosage of 200 milligrams of D.D.T. per square foot and to observe the effects of this on the malaria parasite and spleen rates. About 2,000 houses were treated. Results after three applications are as shown in Table IV,

TABLE IV

*Kericho Malaria**Malaria parasites : two seasons' results.*

	Treated Area		Untreated Area	
	Before treatment and before epidemic	After	Before epidemic	After
General rate	7 o/o	16 o/o	8 o/o	36 o/o
1st year <i>P. falciparum</i> ...	6 o/o	16 o/o	7 o/o	35 o/o
2nd year ,, ...	6 o/o	3 o/o	9 o/o	9 o/o

There is an indication that the treatment checked the seasonal rise in malaria & reduced infections, as in certain of the Kasenje districts of Uganda, but the figures so far are not sufficiently significant. This experiment is, of course, continuing.

It is fairly clear from the results so far obtained in these three African experiments that the African mud and thatch house needs something more than the simple Kerosene — D.D.T. solution. I have mentioned the degree of absorption by mud walls. Emulsions too are absorbed

almost to the same degree as solutions : but with wettable powders in suspension in water we have obtained on the surface of the mud wall as much as 60 o/o of the total amount applied. We are hopeful that such powders made for our specific purposes will go far to provide an answer for Africa.

In Mauritius, your experimental results appear to indicate that the problem of absorption is not so serious as it is in Africa. There is, of course, a smaller proportion of mud huts, and the mud used is of very different texture from the African mud and is more sparingly used. But these differences would not seem to be sufficient to account for the striking difference in effect of D.D.P. solutions applied to mud houses in Mauritius and in Africa. There must be other factors that will undoubtedly come to light with more intensive studies.

This is not the place to describe the very detailed entomological and chemical laboratory studies and estimations that form an essential part of field applications. These studies are continuing in Africa, and others of a more fundamental nature are being started by a special team of scientists in England.

Not only must we find one or more insecticide preparations suitable for application to mud, wood, stone, plaster, distempered and painted walls, but such preparations must maintain toxicities to mosquitoes, flies, and other insects over longer periods than do those in use at present. This means intensive studies of solvents, crystallization, particle sizes of sprays, the design of sprayers and of nozzles and so on. This last subject is of very great importance ; none of the sprayers in use at present is really suitable for the application of residual deposits to house surfaces.

All these studies will subscribe materially to increasing the efficacy and reducing the cost of insecticide applications.

It may be considered that large field experiments should not be undertaken until such investigations as those mentioned above have been completed. We do not subscribe to that view. The knowledge at present in our possession, though far from complete, is adequate justification for properly designed and well controlled large field trials. And in fact it is only by means of such trials that we can make reasonable progress towards the effective and economic use of these new insecticides for the control of major diseases and pests that constitute the main obstacle to a proper economic and social development of most tropical and subtropical countries. Malaria is undoubtedly the greatest of these.

The island-wide experiment to be undertaken in Mauritius by the Colonial Insecticides Committee, on behalf of the Secretary of State for the Colonies, in co-operation with the Health Authorities of Mauritius is,

therefore, an essential item in a programme designed to stimulate the proper application of insecticides, as an essential contribution to development in the Commonwealth. Its results will almost certainly be of great benefit to Mauritius. They will also be of great value to many other territories.

We are aiming at the reduction of malaria to the point of elimination, first by the treatment of houses with insecticides, followed most probably, if this is necessary, by treatment of breeding places, and by any other that may prove to be desirable. It means some years of very hard work—how many years we cannot estimate at present.

But since we can rely upon the full co-operation of all classes of the community, I feel convinced that results will justify the effort, whatever that may be.

FOLIAR DIAGNOSIS : A COMPARATIVE INDEX OF THE MODE OF NUTRITION OF SUGARCANE

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" Mauritius Sugar Industry Reserve Fund ".

In the February issue for 1947 of " Sugar " published in New York, Dr. O W Willcox (1) a leader in agrobiolgy, whilst critically reviewing the progress achieved in sugarcane agriculture during the year 1946, does not hesitate to condemn, in a few words and as a whole, the method of foliar diagnosis.

Willcox, who, in the circumstances, disregards the experimental facts on foliar diagnosis of the sugarcane accumulated in Hawaii (9) and in Mauritius (2, 3, 6, 8, 10) during recent years, also fails to produce any direct experimental evidence, to prove his contention. He only calls attention to a paper relating to sugarbeet published by Van Ginneken in the Netherlands.

As those interested are likely to benefit from more complete information on the problem I will start by recalling on what principle the method of foliar diagnosis is actually based, before producing new experimental evidence of our own in favour of its adoption as a means of controlling the use of fertilizers in sugarcane agriculture.

Professors H. Lagatu and L. Maume (1) of Montpellier, as originators of foliar diagnosis, or the method of inquiry through plant analysis, did not fail to insist from the very start on the exclusively experimental basis of the diagnosis. The following paragraph, translated from their first important paper on the subject published in " *Annales Agronomiques* " of 1930, is a good example of clear enunciation :

" The starting point of foliar diagnosis consists neither in a theory, nor in an hypothesis but in a simple question of experimental nature : is it possible to find out in the variations of the chemical status of a leaf from specifically selected position, useful indications concerning the mode of nutrition of the plant ? If experimentation provides an affirmative answer and shows in what form those indi-

* Note by the author :— This short paper was sent in July 1947 to the Editor of " Sugar " for insertion. After unrestricted acceptance, it finally appeared in the March 1948 issue of that journal with a number of unwarrantable omissions. The full text now appears in the " *Revue Agricole* " in order to dismiss any misunderstanding regarding the essential features of my argumentation.

cations can be revealed, foliar diagnosis will become, ipso-facto, a method of control of the mode of nutrition of the plant, an observational method, based on a *test*, that is on a very small fraction of reality from which it becomes possible, after experimental inquiry, to estimate the whole reality."

H. Lundegarth (4) of Sweden and W. Thomas (7) of Pennsylvania, to mention but two investigators, have also foreseen and refuted a priori criticism of the kind formulated by O. W. Willcox.

It is these very principles, which leave no room for preconceived ideas, that led to our own research (1) on the subject from their commencement in Mauritius in 1936. Willcox is thus using the wrong term when he speaks of "arbitrary rules", as the whole precautional scheme is worked out intentionally, in order that the resulting test or index — foliar diagnosis — should keep its comparative value in the conditions and place where it is going to be put into practice.

Consequently, as soon as the agronomists, in each sugarcane growing country, have succeeded, through adequate experimentation, in finding out the correct rules of comparative leaf sampling to suit their particular conditions, and in establishing the corresponding nutritional optimum in the leaf for each of the commercial cane varieties, then, foliar diagnosis, *under one form or another*, will become, ipso-facto, as is already the case in Mauritius, the favoured method for effecting a permanent control of fertilisation.

The experimental facts shown in a most condensed form in the adjoining tables were established and partially revealed during the last decade, by N. Craig and the author (6) working in collaboration at the Mauritius Sugarcane Research Station, Reduit. These facts, now cover more than a hundred different comparisons between foliar diagnosis, made during full vegetative growth by either the whole leaf (6) or the leaf punch (10) techniques and corresponding weight of canes, obtained at harvest time, on both control and fertilized plots from field trials conducted at several centres over a number of years.

Conclusive proof is now offered that the test — foliar diagnosis under the forms established for Mauritius — is at the same time "faithful, sensitive, and practical" (5). In this connection, the leaf punch sampling technique, (10) followed by photo-electric micro-analysis, fulfils all the desired conditions for the realisation of a biochemical control of sugarcane fertilisation.

In short, no other method can claim to be more direct and to serve agricultural reality better, as the diagnosis, practiced from field to field at biennial intervals, accounts for both space and time factors.

TABLE I

Foliar diagnosis (F.D.) expressed as Nitrogen N, Phosphate P_2O_5 and Potash K_2O per cent dry matter of the leaf tissue, grouped and averaged according to the relative increase ($> 10\%$ or $< 10\%$) in weight of cane, harvested from freely fertilized plots, as compared with control plots.

	Whole Leaf Technique Increase of Cane Wt.		Leaf punch Technique* Increase of cane Wt.	
	superior to 10 o/o	inferior to 10 o/o	superior to 10 o/o	inferior to 10%
Number of different field trials : ...	7 N o/o	2 N o/o	13 N o/o	7 N o/o
F.D. of control plots	1.13	1.46	1.88	2.09
F.D. of plots with <i>Nitrogen Fert</i> : ..	1.33	1.52	2.14	2.27
Number of different field trials : ...	16 P_2O_5 o/o	16 P_2O_5 o/o	4 P_2O_5 o/o	17 P_2O_5 o/o
F.D. of control plots : ...	0.27	0.37	0.40	0.49
F.D. of plots with <i>Phosphats Fert</i> :	0.35	0.41	0.50	0.51
Number of different field trials : ...	14 K_2O o/o	11 K_2O o/o	6 K_2O o/o	14 K_2O o/o
F.D. of control plots :	1.35	2.21	1.15	1.73
F.D. of plots with <i>Potash Fert</i> : ...	2.01	2.31	1.37	1.76

* Mainly on M 134/32 virgin canes aged 8 to 10 months.

TABLE II

Foliar diagnosis (F. D.) expressed as Nitrogen N, Phosphate P_2O_5 and Potash K_2O per cent dry matter of the leaf tissue, grouped and averaged according to the relative increase ($> 10\%$ or $< 10\%$) in weight of cane, harvested from freely fertilized plots as compared with control plots.

	Whole Leaf Technique					
	Increase of cane Wt:					
	superior to 10 o/o			inferior to 10 o/o		
Number of different field trials :	7			4		
F.D. of control plots :	N o/o	P ₂ O ₅ %	K ₂ Oo/o	N o/o	P ₂ O ₅ %	K ₂ Oo/o
F. D. of plots with Complete Fert : ...	1.21	0.31	1.13	1.43	0.37	2.13
	1.42	0.33	1.64	1.46	0.37	2.25
	Leaf punch Technique					
	Increase of cane Wt:					
	superior to 10 o/o			inferior to 10 o/o		
Number of different field trials :	1			nil		
F.D. of control plots :	N o/o	P ₂ O ₅ %	K ₂ Oo/o			
F. D. of plots with Complete Fert : ...	1.63	0.44	0.99			
	2.04	0.46	1.63			

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FACTORY NOTES

E. HADDON

Published Composition of Bagasse

Season ending December 1947

No. of Factory ...	1	2	3	4	5	6	7	8	9	10	11
Sucrose % ...	3.18	2.65	2.60	2.72	3.58	2.65	2.56	2.66	2.41	3.25	3.17
Non sucrose „ ...	0.93	1.01	0.94	0.88	0.91	0.85	0.88	0.94	0.79	1.25	0.89
Moisture „ ...	43.70	44.70	43.00	45.20	43.21	43.20	45.15	44.70	44.00	46.50	46.70
Fibre „ ...	52.19	51.64	53.46	51.20	52.30	53.30	51.41	51.70	52.80	49.06	49.24
Purity mixed juice...	83.10	88.20	86.60	87.00	86.90	87.50	85.10	83.60	88.40	87.00	86.60
„ Juice in bagasse	77.37	72.40	73.44	75.55	79.13	75.71	74.11	73.88	75.31	72.22	78.07
Difference ...	8.73	15.80	13.16	11.45	7.17	11.79	10.69	12.72	12.09	14.78	8.53

No. of Factory ...	...	12	13	14	15	16	17	18	19	20	21
Sucrose % ...	...	2.66	2.51	3.00	3.28	3.60	3.05	3.51	2.82	2.66	2.97
Non sucrose „ ...	...	0.89	1.14	0.93	1.04	1.04	1.08	0.91	1.53	1.47	0.79
Moisture „ ...	...	44.10	46.00	44.31	45.40	46.20	43.85	47.87	44.70	44.36	45.40
Fibre „ ...	...	52.35	50.35	51.74	50.28	49.16	51.02	47.71	50.95	50.51	50.84
Purity mixed juice...	...	86.30	86.70	88.10	85.00	87.00	86.50	88.86	84.80	86.40	87.40
„ juice in bagasse	...	74.92	68.76	75.75	75.92	77.58	73.36	79.41	64.82	71.34	78.98
Difference ...	...	11.38	17.94	12.35	9.08	9.42	13.14	9.45	19.98	15.06	8.42

No. of Factory ...	...	22	23	24	25	26	27	28	29	30	31
Sucrose % ...	...	3.00	3.04	2.87	2.90	2.83	2.66	2.89	2.02	3.14	3.02
Non sucrose „ ...	...	1.18	1.11	0.73	0.92	0.74	0.75	0.96	0.80	1.38	0.98
Moisture „ ...	...	45.00	47.10	44.50	45.60	44.60	42.90	45.30	45.50	44.00	44.20
Fibre „ ...	...	50.82	49.75	51.90	50.88	53.33	53.69	50.05	50.78	50.58	51.80
Purity mixed juice...	...	87.76	86.20	89.26	86.30	87.70	83.50	88.30	88.90	85.20	86.40
„ juice in bagasse	...	71.77	73.25	79.72	75.91	75.49	78.00	77.93	78.49	69.46	75.50
Difference ...	...	15.93	12.95	9.54	10.39	10.81	10.50	10.37	10.41	15.74	10.90

The difference between the purity of the mixed juice and that of the residual juice of the bagasse is erratic and obviously due to one of the constituents not being correct.

In 1911, the writer proposed the adoption of a fixed difference of ten degrees to obtain that of the residual juice (*Bulletin Société des Chimistes* Mai 1911).

The suggestion was adhered to for many years and then forgotten.

The mill extraction having increased from ninety to ninety-five, the difference should now be about ten seventy so as to tally with overseas figures.

For many reasons it is better to adopt a fixed difference than to try to get a sample of juice from generally an unapproachable last pair of rollers (last expressed juice).

To obtain the correct moisture of the bagasse, hourly determinations should be made ; this may require larger ovens to cope with more samples

Weight of crushed canes

So as not to interfere with the chemical control figures, the weight of the crushed canes should, according to the I.S.T.A., be the same as that of the factory's weigh-bridge.

Unfortunately, this is not always adhered to, some factories deduct one per cent for trash from the weight of planters' canes, others make the same deduction from all canes, and a few do not deduct anything.

It is obvious that all factory figures cannot be truly comparable. Economically canes cannot be cleaned before being weighed, moreover with the shortage of labour less attention is paid to the cleanliness of cut canes.

In the writer's opinion, it would be better to deduct the weight of all foreign substances by making use of the sucrose content of representative samples of cleaned canes. (Planters' & Factory's). Millers buy canes for their sucrose content and not for their packing, although in some cases straw is extra fuel.

At any rate the amount of adhering substances should be deducted when payment is made.

Before describing the method that might be used for the determination of sucrose in cleaned canes, let us examine *Natal Factory figures* where no deduction is made, and where the mixed juice is weighed and the imbibition water either weighed or measured by specified meters.

All the operations are checked by Government officials and by several chemists (Planter's & Factory's).

The following are the *Natal factory figures* published and calculated by means of N. Deer's formula which was described in *Revue Agricole* of March and September 1946.

	1946		1947	
	Pu- blished	Calcu- lated	Pu- blished	Calcu- lated
Sucrose in Cane	14.21	14.19	13.32	13.34
Non sucrose	2.49	2.49	2.26	2.27
Water	67.09	67.42	68.62	68.52
Factory fibre (Revue Agricole juin 1947)	16.21	15.90	15.80	15.87
Imbibition water	35.25	34.61	34.37	34.53
Sucrose o/o bagasse	2.79	2.79	2.54	2.54
Non sucrose „ (using purity last expressed juice)	0.92	0.92	0.84	0.84
Moisture „	50.32	50.32	50.46	50.46
Factory fibre „	45.97	45.97	46.16	46.16
Bagasse o/o cane	35.26	34.84	34.22	34.38
Mixed juice o/o cane	99.99	99.99	100.15	100.15
Brix mixed juice	15.42	15.42	14.44	14.44
Purity „	85.86	85.86	86.84	86.24
Purity of last expressed juice (last two rollers)	75.14	75.14	75.03	75.03
„ juice remaining in final bagasse	75.20	75.20	75.14	75.14
Brix of 1st expressed juice ..	20.91	20.91	19.55	19.55
„ absolute juice calculated from juice and bagasse	19.93	19.83	18.50	18.54
by factor of 0.95	19.86	19.86	18.57	18.57
Purity of 1st expressed juice	88.22	88.22	88.48	88.48
„ absolute juice calculated	85.08	85.07	85.49	85.45
„ by factor of 0.964	85.04	85.04	85.29	85.29
Loss of weight of imbibition water or increase	—	1.81%	—	+0.46%
Difference between purity mixed juice and purity residual juice ...	10.66	10.66	11.10	11.10

The above figures show the influence of the percentage of imbibition water on sucrose and on bagasse o/o cane.

Fluctuations in the prevailing temperature of the factory act on the rate of evaporation of juice and added water.

On page 5587 of the Chemical Abstracts of September, 1946, the following statement is found :

Unification of methods of Chemical Control "

" The international system is accepted, but it is pointed out that the method for the determination of imbibition water should not be applied " without correction for loss of weight during grinding ; this loss may " amount to 11.43 o/o. "

A loss of $1\frac{1}{2}$ to 6 o/o was also mentioned at page 9 of de Sornay's Book on Chemical Control published in 1917.

Adhering substances weighed as canes

The amount of adhering substances can be deduced by comparing the sucrose found by Deer's formula with that found by the method published in *Revue Agricole* of June, 1944, and which is based on :

(1) The moisture of a sample of similar canes but thoroughly deprived of all adhering substances.

(2) The brix of the first-expressed juice of the factory when similar canes were crushed, as well as its direct purity.

The moisture of the cleaned canes is obtained by drying 50 grams or more of the very fine pulp produced by a small high speed circular saw which is made to cut longitudinally through the whole length of the sticks.

The small volume of pulp obtained is very quickly and easily mixed. The saw is made of two circular blades $1/16 \times 6$ inches diameter, the blades are fixed together so as to represent one of $1/8$; the teeth are small and similar to those of ordinary hack-saw blades.

The following is a worked out example.

Sucrose by Deer's formula	...	...	...	14.19
Brix of first expressed $\times 0.95$	...	...	...	19.86
Purity „ $\times 0.964$	...	...	...	85.04
Moisture of pulp of cleaned canes	...	...	...	68.01
If 100 of absolute contain	...	19.86	soluble solids	

$$\text{and } \frac{80.14}{100.00} \text{ of water}$$

$$68.01 \text{ of water in cane will contain } \frac{19.86}{80.14} \times 68.01 = 16.85$$

The purity being 85.04, its sucrose is $16.85 \times 85.04 = 14.33$

$$\text{and the amount of adhering substances is } 100 - \frac{14.19}{14.33} \times 100 = 1 \text{ o/o}$$

Imbibition water and bagasse o/o cane

It cannot be repeated often enough that the amount of added water is never equal to that which is in the mixed juice together with what remains in the bagasse.

The amount of bagasse o/o cane is generally made equal to cane + water = mixed juice + bagasse. If the added water is not correct, all the other deduced figures are also not correct.

It is absolutely necessary for correct figures that Deer's formula should be made use of.

The formula not only gives the correct amount of added water but includes any other sources of water which may enter the mixed juice, such as cooling of brasses, leaks, etc.

ANNUAL REPORT OF THE SUGARCANE RESEARCH STATION FOR THE YEAR 1947*

(*Abridged*)

General

From the meteorological standpoint, the year under review was generally characterised by shortage of rain during both the growing and maturing seasons and a temperature somewhat below the normal average throughout the year.

Rainfall was particularly deficient in March. Unsettled weather conditions prevailed during the first quarter but they improved during April and June when good precipitations occurred; rainfall was again below average in May and July, above average in August and practically normal in September. The cool weather experienced throughout most of the ripening season was most favourable to the maturing process. Temperature was below average, while the rainfall was sufficient to maintain the cane in good physiological condition. As a result of these factors extraction of sugar was beyond all expectations, the average figure for the whole colony being 12.5 per cent. as against the previous maximum of 12.1 per cent. in 1943. Yields of cane in the fields were also above estimates, with the result that the 1947 crop amounted to 350,000 tons—the highest on record. Although there is probably a great deal still to be learnt concerning the effect of weather conditions on the growth and maturation processes in the cane, it is highly probable that the following factors were of importance in the attainment of such an outstanding production.

1. Exceptionally favourable growth conditions in November, 1946, gave the young plantations an excellent start: extensive root growth during this period probably helped to tide the cane over the dry conditions during the first quarter of 1947.

2. June rains, which helped the cane in the North of the Island to make up for previous subnormal growth.

3. The relative high proportion of plant cane, first and second ratoons resulting from the replanting in cane of lands under food crops during the war.

4. The high proportion of the Mauritius seeding M. 134/32 and other Sugarcane Research Station seedings which, this year, accounted for 81 per cent. of all the cane harvested.

* Government Press, Mauritius, 1948. pp. 53

5. Maturation conditions were exceptionally favourable and excellent sucrose content was maintained throughout the crushing season. A census of cane varieties was carried out during the year. It showed that the varieties bred at the Sugarcane Research Station were now dominant in the island.

Some of the high lights of these data are given below—

POSITION AT THE END OF 1946

		Area under cultivation in arpents						Total <i>SRS</i> varieties
		<i>M</i> 171/30	<i>M</i> 134/32	<i>M</i> 112/34	<i>M</i> 165/38	<i>M</i> 63/39	<i>M</i> 76/39	
<i>Estates with factories</i>	...	6 259	44.620	1,746	43	56	54	67.108
% of total	...	9.3	66.4	2.6	—	—	—	73
<i>Estates without factories</i>	...	2 073	12.466	192	29	30	31	16.283
% of total	...	12.7	76.5	1.1	—	—	—	90
<i>Grand Total all estates</i>	...	8,332	57 087	1,938	72	86	84	83.396
% of total	...	9.9	68.4	2.3	—	—	—	80.6
<i>Total area (end 1947, estimated)</i>	...	9 282	67,222	2,308	268	383	320	95,680
% of total	...	11.03	80.54	2.74	0.32	0.45	0.38	95.46

PERCENTAGE GROWN IN VARIOUS DISTRICTS AT THE END OF 1946

	<i>M</i> 171/30	<i>M</i> 134/32	<i>M</i> 112/34
Pamplemousses	3.6	75.8	2.6
Rivière du Rempart	1.0	70.9	2.9
Flacq	18.0	58.7	2.6
Moka	19.9	73.6	—
Plaines Wilhems	7.6	71.0	1.1
Black River	8.4	53.8	9.8
Grand Port	10.3	70.3	0.7
Savanne	7.8	65.2	3.4

By far the largest areas of *M. 171/30* are grown in the wet, higher parts of Flacq and Moka, and of *M. 112/34* in the irrigated area of Black River. *M. 134/32* is obviously successful under most climatic conditions but is particularly favoured in the drier localities.

M. 171/30. Rate of growth is somewhat slow during the summer months but this is made good by steady growth during the cool winter months.

It is resistant to borer and red rot, but is affected to some extent with smut in the drier districts. Germination is erratic. It arrows little, gives excellent yields in plant canes; but yields fall away somewhat rapidly in ratoons. The canes maintain their quality late into the harvesting season. In the areas most suitable to it, it is superior to *M. 134/32*. It has excellent factory qualities, the juice is of high purity and is very easy to work;

sucrose content is good, amount of fibre is satisfactory and the burning quality of the bagasse is good.

M.134/32. Very rapid grower which responds markedly to fertilizer applications, particularly to nitrogen ; resists cyclones and droughts admirably. Considerable supplying due to pineapple disease in the drier parts of the North have been obviated by the use of aretan. Somewhat susceptible to red rot when damaged by cyclone and borers. From second ratoons onwards there is a tendency for the canes to be somewhat thinner, and arrowing is fairly heavy. At Black River its appearance is said to be deceptive and yields fall below expectations. In most districts it covers the ground rapidly and reduces weeding costs. It may produce 30-35 tons of cane in 11-12 months, matures early but loses weight when harvested late. Its factory qualities are good. sucrose is high ; it often requires more settling capacity and, in a few instances, defecation of the juice has presented some difficulty. This variety is generally regarded as having benefitted the sugar industry of Mauritius in a similar manner as the famous P.O.J. 2878 cane in Java.

M.112/34. Stated to be particularly suitable for the hot irrigated areas of the coastal districts. It is not a drought resistant variety and with inadequate moisture the canes are reported to be somewhat thin. It appears to be particularly susceptible to pineapple disease and even after treatment with aretan, germination is frequently somewhat erratic. It is severely attacked by borer and is susceptible to red rot disease in the cooler districts. It is somewhat susceptible to phytalulose. When the cane is healthy and yields are good, as in the restricted localities particularly suited to it, the sucrose content and factory characteristics are excellent. It is unlikely that the cultivation of this variety will be extended beyond those regions to which it is particularly suited viz., the irrigated areas of Black River and the wetter, warmer regions of Flacq, Savanne and the North.

The varieties M.165/38, M.63/39 and M.76/39

These varieties were released for trial on a commercial scale at the end of 1945. In the absence of sufficient data about their factory characteristics, planters were advised to slow down the propagation of these varieties until more analytical data were available. Controlled factory tests were made by the Sugar Technology Division during the current harvesting season. In addition, results of further field trials have become available.

On the field side, these varieties are vigorous and high yielding and are resistant to most of the diseases occurring in the island with the exception of chlorotic streak to which they appear to be somewhat susceptible although tolerant. The results of these factory tests and field trials are summarised below, figures for M. 134/32 being given for comparison.

							C.S.S.
<i>M 165/38—Factory tests</i>		<i>Yield of cane in tons per arpent</i>	<i>Purity of 1st Ex- pressed juice</i>	<i>Fibre % cane</i>	<i>Richesse</i>	<i>% cane Tons per arpent</i>	
M 165/38 ...	Mean of 9 tests	44.9	85.8	13.02	13.06	10.89	4.72
M 134/32 ...	Mean of 6 tests	35.2	91.2	12.2	15.10	13.29	4.66
<i>M 165/38—Variety trials</i>							
M 165/38 ...	Mean of 7 trials	35.0	82.76	10.67	14.74	12.57	4.41
M 134/32 ...	" 7 "	30.6	84.47	10.23	15.65	13.60	4.12
<i>M 63/39—Factory tests</i>							
M 63/39 ...	Mean of 6 tests	48.8	96.4	12.4	12.85	10.82	5.16
M 134/32 ...	" 6 "	37.1	90.7	11.6	14.83	13.05	4.76
<i>M 63/39—Variety trials</i>							
M 63/39 ...	Mean of 9 trials	35.7	85.02	11.32	15.44	13.40	4.63
M 134/32 ...	" "	29.4	84.8	10.32	15.75	13.61	3.85
<i>M 76/39—Factory tests</i>							
M 76/39 ...	Mean of 10 tests	44.5	87.03	11.8	13.90	11.83	—
M 134/32 ...	Mean of 9 tests	36.0	90.6	12.04	14.67	12.86	—
<i>M 76/39—Variety trials</i>							
M 76/39 ...	Mean of 9 trials	32.6	83.83	10.97	15.15	12.98	4.19
M 134/32 ...	" "	29.4	84.81	10.32	15.75	13.72	3.96

An analysis of all the available data justify the following conclusions:—

Yield of cane.— These three varieties may be expected to give higher yields of cane than M. 134/32; the average increases in yield of cane per arpent in 1946 and 1947 trials over M. 134/32 are 4.5 tons, 6 tons and 3.0 tons for M. 165/38, M. 63/39 and M. 76/39 respectively.

Purity of Juice.— The purity of the juice is lower in all three varieties than in M. 134/32; it is somewhat higher in M. 63/39 than in the other two varieties.

Fibre content.— M. 165/38 and M. 63/39 have a slightly higher fibre content than M. 134/32; that of M. 76/39 is about equal to the standard.

Sucrose and commercial cane sugar per cent. cane.— The three varieties are invariably lower in sucrose than M. 134/32. The difference is most pronounced when short season canes are harvested early in the milling season. For 15-18 months virgins and ratoons harvested later than October 1st the difference is not so marked, being somewhat lower than 1 per cent. on an absolute basis. There is little to choose between the three varieties with respect to sucrose content. It seems from the data available that reasonably satisfactory juices are obtained if harvesting is delayed until October-November. As, in addition to having a lower sucrose and commercial cane sugar content per cent. cane than M. 134/32, they also mature later, late harvesting seems to be an essential desideratum in the commercial production of these varieties.

Commercial possibilities. — In view of the great dependance of the sugar industry on a single variety, M. 134/32, which now occupies 80 per cent. of the total area under cane, it is well worth while to plant a small acreage of one or other of these varieties as an insurance against a possible failure of M. 134/32. If this is done, arrangements should be made to harvest these canes in October-November, when the increased sugar per acre would probably compensate for the higher transport and manufacturing costs.

Resistance of Mauritian Sugarcane seedlings to diseases occurring in the Island of Réunion

M. 134/32 is now cultivated on a large scale in Réunion in areas normally heavily infected with mosaic disease to which it has so far shown complete immunity.

Of the varieties despatched in January 1946, viz., M. 112/34, M. 165/38, M. 63/39 and M. 76/39, the latter contracted mosaic disease in September, 1947— nine months after being planted in an infected area. The other varieties are not yet affected, but it is too early to gauge the degree of resistance at this stage.

M. 165/38 was stated to be severely affected by Pokkah Boeng.

Varieties introduced from abroad

The six Barbados varieties introduced from Trinidad made satisfactory growth at Réduit. Three field trials were laid down. It is hoped that sufficient data on these varieties will be available by the 1949 crushing season to appraise their value for commercial production in Mauritius.

Cuttings of the Canal Point varieties C.P. 34/120, C.P. 36/13 and C.P. 36/105 arrived in Mauritius in December, 1947, and are now being propagated in the quarantine greenhouse.

At the time of writing cuttings of the Hawaiian variety 32-8560 and the Queensland variety Q28 have been received and have been planted in the quarantine greenhouse.

It is hoped that the introduction of well-tested commercial varieties from abroad together with the seedling selection work at the new Plaines Wilhems Experimental Station will facilitate selection of suitable varieties for the high rainfall areas of the Island where heavy yielding varieties of good sucrose content are the most urgent requirement at present.

Cane Breeding

A very favourable arrowing season enabled the crossing programme to be carried out as contemplated except for a few crosses which could not be made on account of scarcity of arrows in the required parent varieties. None of the recently imported West Indian varieties produced arrows.

One hundred and sixty crosses were made at Réduit and forty-five at

Pamplemousses Experiment Station. From these, 61,310 seedlings were obtained, of which 23,000 were transplanted out.

First Year Trials

(a) *Virgins M/46 series*.— The seedlings of this series planted out at Plaines Wilhems Experiment Station will be selected in July-August 1948.

At the two other Stations, selection was carried out at the end of the crop. At Réduit, 119 seedlings were selected from a population of 7,503 seedlings, or approximately 1.6 per cent.; at Pamplemousses, the corresponding figures were 94 from 6,104 seedlings, or approximately 1.5 per cent.

(b) *Ratoons M/45 series*.— The selection from the ratoon crop of the 1945 seedlings was carried out at Réduit and Pamplemousses. 104 seedlings were selected from a population of 5,920, or approximately 1.7 per cent., and 38 from a population of 2,735, or approximately 1.4 per cent., at these two Stations respectively.

Second Year Trials

Seven trials were planted at Réduit; these included thirty-six varieties of the M/43 series — ratoon selections — and thirty three of the M/44 series — virgin selections. These varieties were also tested simultaneously in trials at Plaines Wilhems Experiment Station. At Pamplemousses, thirteen trials were planted for testing one hundred and twenty varieties of the M./44 series of which fifty-nine were virgin selections and sixty-one ratoon selections.

Thirteen trials which had been reaped in virgins or plant cane in 1946 at Réduit and Pamplemousses were harvested in ratoons during the last crop. No new selections were made from these trials at Réduit, while five varieties were retained at Pamplemousses for further trial.

At Réduit, thirteen varieties, including one for breeding purposes, were selected from eight trials harvested as virgins. At Pamplemousses five trials were harvested in virgins from which nine selections were made.

Third Year Trials

Two trials have been harvested at Réduit at the end of November. One included six M./40 varieties none of which was particularly outstanding. The other included ten varieties bred by Ebène S. E., which the Manager of that Estate considered worthy of propagation. Unfortunately, the cane from several plots in this trial were pilfered for eating purposes and no reliance could be placed on the results. However, the very high sucrose content of some of these varieties indicate that they may prove valuable for commercial cultivation. The most promising of these varieties will be tested under estate conditions in 1948.

At Pamplémousses three trials were reaped in virgins. One variety of the M./41 series and two of the M./42 series were retained from these trials for further testing. Three trials were reaped in first ratoon stage and the results bear out those obtained in virgins. Three trials were planted at Réduit, Two at Pamplémousses and two at Plaines Wilhems Experiment Station. In these trials one variety of the M./40 series, thirty-two of the M./41, six of the M./42 and five of the M./43 series are being tested.

Variety Trials

Sixteen trials were harvested on estates during the crop. Nine of these included the varieties M. 165/38, M. 63/39 and M. 76/39, the results of which have already been given. The results of the varieties tested in the other seven trials showed that M. 213/40 has given significantly better yields of cane than the standard (M. 134/32) and that in six out of the seven trials its yields of commercial sugar per arpent have also been significantly higher. These figures are given below :

	<i>Localities</i>		
	<i>Union Ducray</i>	<i>Labourdonnais</i>	<i>Savinia</i>
M 213/40 : (virgins)	*		
Tons cane per arpent ...	+ 13.9 ± 10.5	+ 7.0 ± 5.6	+ 4.7 ± 1.9
C.C.S. per cent. cane ...	— 0.4	— 0.5	— 0.5
Tons C.C.S. per arpent ...	+ 1.43 ± 1.22	+ 0.81 ± 0.76	+ 0.44 ± 0.23

	<i>Localities</i>	
	<i>Mon Loisir</i>	<i>St. Aubin</i>
M 213/40 : (virgins)		
Tons canes per arpent ...	+ 4.6 ± 4.6	+ 10.7 ± 5.2
C.C.S. per cent. cane ...	— 1.7	+ 0.7
Tons C.C.S. per arpent ...	— 0.12 ± 0.59	+ 17.8 ± 0.64

	<i>Localities</i>	
	<i>Bénarès</i>	<i>Bel Ombre</i>
M 213/40 : (virgins)		
Tons canes per arpent ...	+ 17.4 ± 7.5	+ 10.1 ± 2.8
C.C.S. per cent. cane ...	+ 0.2	— 0.4
Tons C.C.S. per arpent ...	+ 2.13 ± 0.86	+ 1.36 ± 0.40

* Significant difference.

Figures in bold type = significantly superior to standard.

Fertilizer Trials

The main line of work has for some years been concerned with the development of the Poliar diagnosis technique of determining the nutrient status of sugarcane, the basic data being obtained from a comprehensive series of $3 \times 3 \times 3$ factorial experiments testing the effect of three levels of nitrogen, potash and phosphate in all combinations in the different soil types and climatic regions of the Island.

This work is of great practical value and its continuation without interruption was considered a major objective.

Results of Trial 69 Réduit.— Comparing high and low fertilization of the varieties M. 112/34 and M. 134/32.

The low level of fertilization consists of 25 kilos each of sulphate of ammonia, nitrate of potash and phosphatic guano; the high level consists of 100 kilos of each of these fertilizers. The fertilizers are applied in one application as soon as possible after the harvesting of the previous crop.

The yields obtained to date in this trial are summarized below—

		M 134/32	M 112/34	M 112/34	High fertilization	
		Tons per	Tons per	compared	compared to low	
		arpent	arpent	with	fertilization	
				M 134/32	Tons per arpent	
				Tons per arpent	M 134/32	M 112/34
Virgins 1943	{ High ...	34.3	33.5	—0.8	}	+ 10.4
	{ Low ...	23.9	23.1	—0.8		
1st ratoons 1944	{ High ...	22.9	22.9	Nil	}	+ 8.7
	{ Low ...	14.2	16.4	+ 2.2		
2nd ratoons 1945	{ High ...	23.8	23.6	—0.2	}	+ 9.8
	{ Low ...	14.0	16.3	+ 2.3		
3rd ratoons 1946	{ High ...	34.0	31.0	—3.0	}	+ 19.8
	{ Low ...	14.2	17.6	+ 3.4		
4th ratoons 1947	{ High ...	37.1 (805)	33.4 (630)	—3.7	}	+ 23.9
	{ Low ...	13.2 (500)	15.2 (425)	+ 2.0		

(Figures in brackets are the weights of 30 leaves of third rank sampled on 26.2.27).

This trial shows some features of considerable interest. Whereas the variety M. 112/34 has consistently outyielded M. 134/32 in the low fertilized plots, it has been consistently inferior to the latter variety in the high fertilized plots. The fact is of interest in relation to the widely held belief that an essential criterion of a good variety is its ability to respond to fertilizer applications.

Results of Trial Bio. 5.— To compare the effect of complete fertilization and withholding potash and phosphate.

The complete fertilizer plots have been given 150 kilos sulphate of ammonia, 100 kilos guano phosphate and 80 kilos sulphate of potash. The —P and —K plots have received the same quantity of the fertilizers other than those withheld.

The yield data in tons per arpent are summarized below—

		Complete	Minus potash	Minus phosphate
Virgins 1944 ...	...	26.8	19.5	16.2
1st ratoons 1945 ...	...	27.2	19.1	20.9
Second ratoons 1946...		36.4	29.6	30.0
Third ratoons 1947 ...		39.6	25.7	29.5

It is evident that considerable deficiencies of potash and phosphate are increasing with successive cropping in this trial, the potash deficiency being somewhat greater than that of phosphate. An interesting feature of these results is the manner in which ratoon yields are being maintained by correct fertilization. As the yields in the island as a whole decrease appreciably with increasing age of ratoons, it is possible that a better maintenance of ratoon yields would result from higher fertilization of the ratoons. This is also well shown in the results of the St. André (Solitude S. E.) optimum nitrogen trial of which the results are given below —

St. André (Solitude S. E.) Optimum Nitrogen Trial

Yields in tons per acre										
Kilos sulphate of ammonia per arpent	Virgins 1941	1st ra- toons 1942	2nd ra- toons 1943	3rd ra- toons 1944	4th ra- toons 1945	5th ra- toons 1946	6th ra- toons 1947	Mean 1941-47	Mean extrac- tion 1941-47	Mean Tons sugar 1941-47
0	40.9	23.3	23.8	22.0	18.0	21.4	15.2	23.5	12.06	2.83
75	44.3	32.8	31.3	24.8	21.8	25.0	20.9	28.7	11.95	3.43
150	45.8	34.8	32.9	27.5	23.6	30.9	29.1	32.1	11.61	3.73
225	47.9	36.3	36.3	32.3	27.4	35.4	31.3	35.3	11.35	4.01

A good response to nitrogen has been obtained even to the highest dosage used, and the yields of six ratoon crops have been very well maintained whereas, with low nitrogen fertilization, the yields of the ratoons have fallen off considerably. There is a decrease in extraction with increased dosage of nitrogen, but the increased tonnage has more than made up for this and the response of 0.28 ton of sugar to the last increment of 75 kilos sulphate of ammonia is profitable.

Factorial Fertilizer Trial

The dosages of fertilizers given in the plant cane crop were —

	0	1	2		0	1	2
N ...	0	34	63	N	0	30	60
P ₂ O ₅ ...	0	30	60	and the amounts in ratoons P ₂ O ₅	0	25	50
K ₂ O ...	0	35	70	K ₂ O	0	30	60

In all the trials the leaves of the different treatments were sampled during the season of maximum growth and at harvest composite samples of cane were taken for sucrose, juice purity, etc.

In virgins, in 1946, the main response to nitrogen was always positive, but the responses to the double dose of phosphate was frequently negative. The occurrence of thirteen negative responses from eighteen trials, two of which were significant, indicated that there might be a real depressing effect of the double dose of phosphate.

The 1947 results demonstrated a considerably greater response to nitrogen in first ratoons as compared to that obtained in virgins and showed that the suspected depressing effect of phosphate had practically disappeared.

The whole series of experiments considered collectively showed no appreciable interaction between any of the three elements. The data on yields and relative growth indices at the three levels of nitrogen, phosphate and potash fertilization can be summarized as follows :—

Comparative Yield of Millable Cane

Average of 17 trials	Nitrogen (N)			Phosphoric Acid (P_2O_5)			Potash K_2O		
	0	1	2	0	1	2	0	1	2
Tons cane per arpent ...	24.6	31.9	32.7	29.5	29.8	29.8	29.0	30.0	30.1
Comparative yield ...	100	130	133	100	101	101	100	103	104

As regards quality, increasing the nitrogen has resulted in a decrease in commercial cane sugar per cent cane, in the purity of the juice and in the fibre content. The yield of sugar increased but there was practically no difference between the single and the double dose.

Demonstration plots on fertilizer requirements on small planters' lands

Seven demonstration plots on the necessity of applying phosphatic guano were harvested during the year. In some of these, the small planters themselves gave relatively high dressing of farmyard manure. Nevertheless considerable responses to phosphate were frequently obtained. At Cluny where many small planters have not been applying phosphate, application of phosphate fertilizer increased the yield from 9.3 tons per arpent to 20.6 tons. Responses of 1 to 4 tons per acre were obtained in some of the other demonstration plots.

Leaf samples for Foliar diagnosis are now taken from small planters' fields and the analysis of these will form a valuable guide in laying down fertilizer demonstration plots to correct the major deficiencies.

Weed Control Investigations Gramineæ

Cynodon dactylon (Chiendent).— Extensive experiments with most of the herbicides commercially available showed that sodium chlorate was considerably superior to other herbicides. The success achieved with sodium chlorate depends to a considerable degree on the locality where the grass is located and on the stage of growth of the grass when treated. Thus, at Flacq, chiendent is not deeply rooted — and complete control is obtained with one application of 10 per cent. sodium chlorate, if the herbicide is applied under dry conditions and with double the usual addition of wetting agent. In the Savanne, lower Plaines Wilhems and Black River districts, the rhizomes penetrate deeply and a single application of 10 per cent. sodium chlorate gives very poor control. Under these conditions a considerable reduction in the population of the weed is obtained by first burning the existing growth and spraying the new growth which emerges with either 10 per cent. sodium chlorate or ammonium sulphamate at 2-3 lbs. to the gallon. An alternative method is to dig out the chiendent in the first few inches of soil by an ordinary cleaning operation with hoes and to destroy new growth with the herbicide.

Providing that these chemicals are not sprayed at rates higher than 100 gallons per acre, the field can be almost immediately planted in cane, particularly if a dressing of farmyard manure and a small quantity of nitrate fertilizer is applied at planting. Under these conditions there is practically no toxic effect on the young cane plants and the infestation of chiendent is reduced to such an extent that the growing cane easily controls the weed.

The chemical methods of control described above are particularly applicable to dry stony soils : where infestation occurs in the free soils of the wet districts mechanical means of control are particularly effective in reducing the infestation prior to cane planting. For this purpose, a very effective implement at present in use in Mauritius is a type of V blade weeder designed by Mr. Charles de Spéville, of Mon Désert S.E. This implement is drawn by a tractor and cuts all weeds at a depth of approximately six inches, the soil passing over the blade. The weeds thus loosened are easily removed from the field by hand and are either composted or burnt at the side of the field.

Phalaris arundinacea (Mackaye).— Extensive experiments on the control of this weed has confirmed the previous recommendation that sodium chlorate at 10 per cent. concentration is the most effective method of controlling this weed. In most cases 70-80 per cent. of the rhizomes are destroyed by one application of sodium chlorate, but a further application may be necessary for complete control. An economy in the use of herbicide is obtained by using the V-blade weeder, or alternatively by disc ploughing and removing the weeds thus loosened by hand. Regrowth following this operation is then destroyed with sodium

chlorate. Small areas in standing cane may be effectively suppressed with a cheap compounded herbicide developed at this Station during the year. Sodium chlorate is very effective in killing the weed on tramway tracks and cane field roads and to prevent encroachment of the weed into the fields.

Echinocloa colona (Herbe sifflette).— Considerable success has followed the use of sodium chlorate on this weed in the Flacq district. Two applications of 10 per cent. chlorate reduced the weed by 80-90 per cent. and under these conditions the cane successfully competes with the weed and the infestation is reduced still further.

Herbe Riz (at present unidentified).— This graminaceous weed occurs in localized areas in the wetter parts of Mon Désert S. W. It was successfully controlled by sodium chlorate only when the soil was dry — along river banks and in badly drained areas regrowth occurred. This was in marked contrast with areas of the weed growing on slopes with good drainage, where control of the weed with sodium chlorate was complete after one application at 10 per cent. concentration with a suitable wetter.

Saccharum spontaneum.— This weed found at Réunion and Henrietta impossible to remove by digging, rhizomes penetrating to a depth of 5 to 6 feet and the operation of removal, costing about Rs. 800 per acre being prohibitive.

Fortunately, it was very susceptible to sodium chlorate and almost all the areas infested have now been economically cleared. Here again the most effective dosage was 10 per cent. chlorate. Only a few weak, chlorotic shoots appeared several weeks after a single application of 10 per cent. chlorate and spot-spraying of these completed the eradication. It was noted that penetration of the chlorate along the rhizome was extraordinarily deep, the rhizomes becoming discoloured and rotted. Buds sprouting from unaffected parts of the rhizomes were too deep for survival and most perished before reaching the soil surface.

Imperata cylindrica (Lalang grass).— The Agricultural Division has been engaged for some time in a campaign for the eradication of this noxious weed, which apparently escaped from the Royal Botanic Gardens and is found in restricted localities particularly in the north and centre of the island. Experiments were carried out at various times of the year for the control of this weed using sodium chlorate and ammonium sulphamate. The results, however, indicated that control of this weed by chemical means was not economic at present prices. Repeated applications of large dosages of sodium chlorate and ammonium sulphamate failed to eradicate the weed. At present grubbing out or destruction by flame throwers at frequent intervals offers the most economic method of eradication.

Ischaemum aristatum (Herbe d'Argent).— Since this weed is found in the wetter free soils the V-blade weeder is the most effective method of control.

Annual graminaceous weeds.—Practically all the annual graminaceous weeds are effectively controlled by sodium chlorate, ammonium sulphamate, arsenic and mineral oils. The chief consideration is the cost of eradication. Excellent results against herbe Bambou (*Setaria barbata*), *Chloris pycnothrix*, etc., have been obtained with Diesel oil and with Stoddard solvent as well as with sodium chlorate at 5-10 per cent. and ammonium sulphamate at 2-3 lbs. per gallon.

Using the Hawaiian solutions as standard, Dr. H. Evans prepared several such activated solutions and after some experimentation, a very useful general purpose herbicide was prepared.

This mixture has the following composition —

- | | | | |
|------|--|---|---------------------|
| A. { | { | 80 grams ammonium dinitroorthoeresol | } in 400 cc. water. |
| | | 80 grams ammonium sulphamate. | |
| | { | 200 grams of a 1 : 1 emulsion of Stoddard solvent or Diesel oil | |
| | | in 1 per cent. soap solution. | |
| | | 50 grams Teepol wetter. | |
| { | 80 grams. sodium chlorate in 200 cc. of water. | | |
| | 200 grams 6 per cent. solution of sodium arsenite. | | |

It is very stable, keeps indefinitely and only requires slight agitation before use. It is miscible with water in all proportions and is used at a dilution of X20 to X60. Its general herbicidal properties at least equal the best Hawaiian solution tested here and on decomposing in the soil a certain amount of nitrogenous fertilizer from the ammonium DNOC and the ammonium sulphamate becomes available.

At concentrations of X20, most weeds are killed or seriously damaged by this herbicide, but it can be used in growing cane without much harmful effect on the cane at concentrations of X20 if care is avoided to spray the canes.

One of its great advantages is that the hormone herbicides can be freely mixed with it without reducing their activity to any great extent, thus ensuring a considerably wider range of activity than can be obtained with simple herbicides.

The compounded herbicide described above is very efficacious against young grass seedlings—which are not affected by the hormone weed killers—and more mature grass weeds are scorched to soil level and suppressed to such an extent that they cannot colonize areas of susceptible weeds killed by methoxone or 2-4 D.

Cyperaceae

***Cyperus rotundus*.**—A considerable amount of further work has been carried out particularly on *Cyperus rotundus* (Herbe à Oignon) on which five herbicides were tried.

In all cases, although the existing aerial shoots were killed, a luxuriant new growth developed within three to four weeks of the original application

even after treatment with 0.3 per cent. concentration of the active substances.

Cyperus rotundus has been completely controlled in Natal with agro-cane dust at 3 cwt. per acre. The same substance at 300 kilos per acre has failed to give complete control under Mauritius conditions.

Spraying of the furrows only in which the cane is to be planted has been found to give very encouraging results. In making the furrows a considerable number of tubers are lifted from the furrows and buried in the banks. The density of nut grass growth in the furrows or holes is accordingly considerably less than in the banks. Spraying the furrows gives good practical control of the weed. This enables the first clearing operation by implements to be considerably delayed in that by keeping the furrows clean competition with the young cane plants is greatly reduced.

Umbelliferae

Hydrocotyle bonariensis (Herbe Bol or Tam Tam).— The most spectacular success of the hormone weed killers in Mauritius has been in the control of this weed. In young cane plantations two applications of 0.1 per cent. MCPA or DCPA has given effective control.

Herbe Bol has been used as a test plant to evaluate a large number of hormone weed killers which were on sale on the local market. Some fifty demonstration sprayings were made at the request of planters, and large-scale routine spraying of areas covered by this weed on estates has given results fully up to expectations. It is estimated that the weed has now been eradicated from an area of 2,500 to 3,000 arpents.

Compositae

Ambrosia artemisiifolia (Herbe Solferino). — Further work has been carried out on this weed species at different periods of the year, and the results obtained have surpassed those recorded in the preliminary experiments. The weed grows actively during the period September-December, when it is considerably more susceptible to hormone herbicide: a rank growth of the weed in the early flowering stage was completely killed by a single application of M. C. P. A. or D. C. P. A. at 0.2 per cent.

Artemisia vulgaris (Herbe Chinois). — Further experiments on this weed which, under Mauritius conditions, spreads solely by vegetative means, have confirmed that complete eradication may be effected with 10 per cent. sodium chlorate.

Tridax procumbens (Herbe Caille).— This weed is susceptible to the hormone herbicides and may be eradicated completely by treatment with these substances. At a spraying rate of 100 gallons per acre, the critical concentration for complete eradication lies between 0.15 per cent and 0.2 per cent.

Cordia macrostachya (Herbe Condé).— A chemical herbicide for the

complete eradication of herbe cordé has been found. This is ammonium sulphamate. Herbe cordé is particularly susceptible to this herbicide which penetrates into the root stock and completely kills the plants. With low concentrations complete defoliation of the plant occurs but to prevent regrowth from the root stock a concentration of 2-3 lbs. per gallon is required. As the cost of ammonium sulphamate is somewhat high, a considerable economy can be effected in clearing cordé land, if the cordé is first cut down and the new growth sprayed with the sulphamate solution. As ammonium sulphamate is not manufactured in the United Kingdom it is unlikely that supplies of this substance will be available for commercial use for some time.

On free soils herbe cordé is easily eradicated in fallow land by the use of heavy cultivation implements such as disc ploughs. It is in rocky areas and in walls that chemical methods are particularly useful for the destruction of this weed.

Rubiaceae

Pæleria foetida (Liane Lingue) — In spite of intensive experimentation no satisfactory method of controlling liane lingue has materialized.

Leguminosae

Further experiments carried out on sappan (*Acacia concinna*) have fully confirmed the preliminary results obtained with sodium chlorate on this weed. Complete control is obtained with one spray application of 10 per cent. sodium chlorate providing the application is made in dry weather. Large bushes several feet high have been effectively eradicated by this method.

Effects of hormone herbicides on the growth of sugarcane.— Young sugarcane plants of the variety M. 134/32 and various seedling varieties were sprayed with methoxone (M.C.P.A.) and ammonium 2-4 D. at various concentrations. At the maximum concentrations normally employed (0.25 per cent.—0.30 per cent.) any deleterious effects are transient and may include a temporary reduction in the rate of elongation, some pigmentation of the leaves, occasionally some chlorotic lesions on the younger leaves and abnormal root primordia. Within three to four weeks the plants fully recover from these temporary effects; at a concentration of 0.1—0.15 per cent. even these temporary effects are of rare occurrence.

Effect on the growth of maize.— Maize is considerably more susceptible to these substances than sugarcane. The chief effects are marked curvature of the stem of the plants and abnormal development of the root primordia. If the maize is treated in its early stages of growth the effect of the hormone herbicides is negligible and the later treatments do

not affect culm formation, but the plants may be recumbent and less firmly anchored in the soil.

Suggested procedure for the chemical weeding of cane plantations.— Assuming that noxious grass weeds have been removed prior to plantation, the first weeding of the young cane plants may be carried out with methoxone or 2-4 D product at 0.1-0.15 per cent. If labour is scarce at this time (as frequently is the case in crop time) the cane holes or furrows only may be sprayed. This enables the immediate vicinity of the young cane plants to be kept free of weeds. Should it be necessary to spray the inter-lines also, they should be sprayed as a separate operation using the Réduit compounded herbicide described earlier at X20 dilution either with or without the incorporation of hormone herbicides care being taken to avoid spraying the young cane plants.

When the young shoots are 18-24 inches in height, it is possible to incorporate dressings of sulphate of ammonia in the hormone herbicide spray. Sulphate of ammonia at 1 lb. per gallon (giving a dressing of 100 lbs. per arpent) may be added to 0.1-0.15 per cent. M.C.P.A. or D.C.P.A. and the mixture used for the cane holes or furrows. Sulphate of ammonia thus incorporated will extend the activity of the herbicide to control broad-leaved weeds which are resistant to the hormone herbicides, e.g., *Solanum nigrum* (bréde martin) *Acalypha indica* (herbe chatte), etc., and will scorch young grass seedlings. The interlines should later be cleared by hoe if there is growth of noxious weeds such as grasses and resistant sedges, (e.g., *Portulaca*, *Killingia polyphylla*), etc. Alternatively the interlines may be sprayed with the Réduit compounded herbicide at X20.

When the cane plants are about six months old both the rows and the interlines may be sprayed with the Réduit compounded herbicide at X40 to X50. If weeds susceptible to hormone herbicides such as herbe bol, herbe chinois, etc., are present, methoxone or 2-4 D is incorporated in the spray at 0.15-0.20 per cent. For all further weedings which may be necessary this mixture would be used. If patches of resistant weeds such as mackaye (*Phalaris arundinacea*), chiendent (*Cynodon dactylon*), etc., are still present these may be spot-sprayed with the Réduit compounded mixture at X15 to X20 dilution providing that care is taken to avoid direct spraying of sugarcane leaves. No harmful effects on the cane plants through applications to the soil near the base of the plants will result from this treatment.

Suggested procedure for the weeding of Aloe fibre plantations.— Many aloe fibre plantations are made in the rocky soils of the drier regions where the most important weeds are shrubby weeds particularly herbe condé (*Cordia macrostachya*) and vieille fille (*Lantana camara*). It is difficult to eliminate these by cultural means prior to making the plantation. These shrubs should be cut as close to the ground as possible prior to making the plantation and when new shoots are 8-12 inches high,

the condé plants should be sprayed with ammonium sulphamate at 2-3 lbs. per gallon and the vieille fille with methoxone or 2,4 D at 0.2 per cent. These treatments will kill these plants, but new seedlings may later arise from seed. The same treatment may be used to eradicate condé from pastures on rocky lands.

Alternatively the aloe bulbils may be planted after the shrubby weeds have been cut down, the latter being suppressed by spraying at intervals with the Réduit compounded herbicide at X 40 to X 60. This concentration is sufficient to defoliate the young shoots of these plants at the low cost of Rs. 5-6 per arpent. This treatment is repeated when necessary and will keep these shrubby weeds permanently suppressed and they will finally die.

Spraying equipment.— The spraying equipment generally in use at present is inadequate for any considerable extension of the spraying programme. On flat terrain power sprayers can be effectively used either directly propelled or attached to a tractor: smaller types may be mounted on bullock carts. On rocky uneven land it is probable that the system of using one pump at the side of the field to pump the liquid and obtain the required pressure for a unit of 10 or 12 portable sprayers is the most effective system. No such units are at present in use in Mauritius.

Investigations on the fertilizer value of crushed basaltic rock.— Experiments carried out for many years by Highlands S.E. have shown conclusively that the application of rock dust at rates up to 90 tons per acre caused a significant increase in both cane yields and in the sucrose content of the juice.

It was considered, therefore, that this subject required thorough investigations—

- (a) with a view to determining whether the preparation and application of rock dust is economically feasible; and
- (b) to attempt to determine what constituent or constituents of the dust is responsible for the increase in cane yield and quality and whether or not the physical effect of the dust on the soil is also important.

Accordingly, a $3 \times 2 \times 2$ factorial experiment has been laid out at Hermitage; pending its conclusion, a series of pot culture experiments was begun and the results of the first series are now available.

It was found that this Hermitage soil when given adequate quantities of the major fertilizers produced magnesium deficiency symptoms in oat plants, indicating that the reserves of available magnesium are very low.

It was also determined that the addition of the equivalent of 100

tons per acre of rock dust resulted in an increase in yield of 33.7 per cent. when nitrogen was the only additional fertilizer given. Increasing the quantity of dust applied to 200 tons per acre resulted in a total increase of 56.4 per cent. over the controls. These increases are highly significant.

The results of this experiment may be summarized as follows—

1. The Hermitage soil is highly deficient in nitrogen, potash and phosphate, and possibly in magnesium and other elements.
2. Rock dust supplies an appreciable quantity of available potash but little or no available phosphate.
3. When the requirements of the soil for nitrogen, potash and phosphate are satisfied, a deficiency of magnesium manifests itself.
4. When phosphate requirements are satisfied, the oat plants take up appreciable quantities of calcium and magnesium from the rock dust.

This experiment is naturally only a beginning in so far as unravelling the full effects of the dust on plant growth on these poor soils is concerned. Nevertheless, it is now known that potash, calcium and magnesium are supplied by the dust but not phosphate. Further experiments are in progress to determine what other elements are supplied by the comminuted rock.

Some preliminary field experiments have also been laid out to test the effect of applications of additional mineral nutrients such as magnesium, zinc, manganese, etc., on these poor soils. The elucidation of the problems of mineral nutrition of the cane on these poor, highly leached soils of the wet districts may have considerable practical value. There is very little doubt that magnesium may, at times, be deficient in these soils, particularly under heavy rainfall conditions and some responses to leaf tip injection of magnesium salts have been obtained on cane grown in these regions. It is possible also that one or more trace elements are deficient but not to a sufficient extent to produce clearly defined symptoms.

Various other investigations were carried out, e.g. on the use of organo-mercuric compounds for the treatment of cane cuttings, which was done with the co-operation of the Plant Pathologist, on the preservation of sugar cane pollen for breeding work and on the control of certain weeds of specialized habitats.

STATISTIQUES

1^o. CLIMATOLOGIE

(a) Pluviométrie (Pouces)

LOCALITÉS	NORD								CENTRE				
	Grand' Baie	Pample-mousses	Pample-mousses (Normale)	Aber-crombie	Aber-crombie (Normale)	Ruisseau Rose	Belle Vue Maurici	Beau Bois (Moka)	Helvétia	Réduit	Réduit (Normale)	Curepipe*	Curepipe (Normale)
Mars 1948	—	7.23	9.32	4.92	9.00	6.67	—	7.45	9.88	8.46	11.94	8.62	19.31
Avril "	—	7.19	5.96	8.00	6.21	7.69	—	12.00	8.22	6.50	5.41	17.06	12.39

LOCALITÉS MOIS	EST				OUEST					SUD			
	Centre de Flacq	Camp de Masque	Palmar	G.R.S.E.	Port-Louis	Case Noyale	Beau- Bassin	Beau- Bassin (Normale)	Richelieu	Rose Belle	Richelieu- en-Fau	Camp Diable	Chemin Granier
Mars 1948	8.93	10.32	7.40	6.20	10.35	—	7.45	7.88	4.45	8.57	—	11.47	19.84
Avril „	12.40	12.76	9.33	9.96	9.09	3.88	5.52	4.01	5.52	18.67	—	7.24	12.12

(b) Température °C

Localités	Beau-Bassin		Réduit				Curepipe*		Richelieu	
	Max.	Min.	Max.	Min.	Moy.	Nor.	Max.	Min.	Max.	Min.
Mars 1948	30.3	21.1	27.8	20.7	24.0	23.8	26.3	20.0	29.3	25.1
Avril "	29.6	20.6	25.4	19.4	22.6	22.6	23.8	19.5	28.5	23.2

(c) Insolation

Réduit		
Mois	Heures de soleil	Fraction d'insolation
Mars 1948	225.53	59.6 %
Avril "	211.58	60.9 %

20.—Meteorological Return — January to March — 1948.

RAINFALL

Principal Stations	JANUARY		FEBRUARY		MARCH	
	Inches of rain	Departure from normal	Inches of rain	Departure from normal	Inches of rain	Departure from normal
Pamplemousses (Royal Botanical Gardens) ...	3.94	—59%	1.65	—81%	7.23	—22%
Abercrombie Nursery ...	4.44	—50%	3.76	—48%	4.92	—45%
Reduit (Department of Agriculture) ..	8.33	—19%	4.63	—58%	8.46	—29%
Curepipe (Royal College) ...	11.16	—32%	11.14	—36%	8.62	—55%
Beau-Passin (Barkly Expt. Station) ...	5.79	—14%	4.10	—49%	7.45	—5%

TEMPERATURE & SUNSHINE AT REDUIT

Months			Mean monthly temperature	Departure from normal	Total registered sunshine (hrs)	% of possible sunshine
JANUARY	...	...	24.5	+ 0.2	224.30	55.0
FEBRUARY	...	...	24.1	— 0.2	277.08	72.0
MARCH	...	...	24.0	+ 0.2	225.53	59.6

30. COMPILATION OF THE 1947 SUGAR CROP (Unit : Metric Tons)

Districts	Cane crushed	Vesous	Raw	Low	Total sugar produced	Richesse %	Extraction %
Pamplemousses ...	287,014	—	37,325	10	37,335	14.90	13.01
Riv. du Rempart ...	384,917	7,360	42,657	—	50,017	14.76	12.99
Flacq ...	413,872	—	50,329	31	50,360	13.88	12.16
Moka ...	322,667	—	39,199	—	39,199	13.98	12.15
Plaines Wilhems ...	240,455	—	30,753	57	39,810	14.35	12.81
Black River ...	120,221	14,426	—	—	14,426	14.62	12.00
Savanne ...	480,697	—	59,321	—	59,321	14.33	12.34
Grand Port ...	550,650	7,261	59,802	—	67,063	14.08	12.13
TOTAL ...	2,800,483	29,047	319,386	98	348,531	Mean extraction „ (1946)	12.45 11.5%

Weights expressed as a % of

Total Sugar Manufactured : 8.33% 91.64% 0.03% 100.00

Corresponding figures for 1946 : 13.47% 86.48% 0.05% 100.00

40. SUGAR PRODUCTION — 1942-47 (Unit : 1,000 metric tons)

Districts	1947	1946	1945	1944	1943	1942
Rivière du Rempart ...	50.02	86.70	41.71	57.60	77.64	73.60
Pamplemousses ...	37.32					
Flacq ...	50.36	41.29	21.05	29.88	45.74	51.53
Moka ...	39.20	31.15	15.47	29.97	40.29	40.42
Plaines Wilhems ...	30.81	23.08	10.18	14.85	23.42	23.92
Black River ...	14.43	11.12	6.61	8.47	13.49	15.07
Savanne ...	59.32	47.39	22.04	33.95	55.71	61.36
Grand Port ...	67.06	50.33	21.99	30.82	54.43	64.98
Total ...	348.53	291.06	139.05	199.64	310.72	330.88

Note :— The compilation of the 1947 crop is based on chemical control figures obtained from the factories. They might differ slightly from those obtained from other sources. The final and official figures for the 1947 crop will not be known until the last shipment is loaded, in June or July, 1947.

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50. PRODUCTION SUCRIÈRE DES USINES EN 1947

Usine	Cannes manipulées Tonnes	Sucre Fabriqué			Total Tonnes	Richesse	Ext. %
		Blanc Tonnes	Roux Tonnes	B.P.			
PAMPLEMOUSSES							
Beau Plan ...	73,599	—	10,143	—	10,143	15.44	13.78
Solitude ...	93,244	—	11,842	—	11,842	14.84	12.70
The Mount ...	120,171	—	15,340	10,0	15,350	14.63	12.77
RIVIERE DU REMPART							
Belle Vue ...	57,67	—	7,686	—	7,686	15.42	13.38
Labourdonnais ...	82,136	—	11,321	—	11,321	15.37	13.73
St. Antoine ...	98,677	7,360	4,637	—	11,997	15.19	12.16
Mon Loisir ...	146,727	—	19,063	—	19,063	14.72	12.99
PLAINES WILHEMS							
Trianon ...	60,244	—	7,798	52,2	7,850	15.24	13.03
Réunion ...	62,396	—	7,649	—	7,649	13.79	12.16
Highlands ...	117,316	—	15,307	4,4	15,311	14.52	13.06
SAVANNE							
Savannah ...	67,012	—	8,409	—	8,409	14.83	12.55
Bénarès ...	71,360	—	8,869	—	8,869	14.69	12.43
Bel Ombre ...	52,387	—	6,515	—	6,516	14.60	12.44
Terracine ...	57,763	—	7,139	—	7,139	14.29	12.35
Union St. Aubin ...	84,867	—	10,114	—	10,114	14.24	11.91
St. Félix ...	50,498	—	6,354	—	6,354	14.15	12.58
Britannia ...	96,804	—	11,920	—	11,920	13.78	12.31
BLACK RIVER							
Médine ...	120,221	14,426	—	—	14,426	14.62	12.00
MOKA							
Mon Désert ...	194,923	—	24,509	—	24,509	14.43	12.57
Sans Souci ...	127,741	—	14,690	—	14,690	13.25	11.50
FLACQ							
Constance ...	104,703	—	13,243	—	13,243	14.15	12.05
Union Flacq ...	91,836	—	11,504	—	11,504	13.87	12.53
Queen Victoria ...	83,765	—	10,084	—	10,084	13.73	12.04
Beau Champ ...	69,382	—	8,160	31,0	8,191	13.61	11.81
Deep River ...	64,186	—	7,338	—	7,338	13.44	11.48
GRAND PORT							
Savinia ...	115,376	—	14,305	—	14,305	14.38	12.40
Beau Vallon ...	65,417	847,000	6,090	—	6,937	14.30	12.51
Mon Trésor ...	147,832	—	18,349	—	18,349	14.16	12.41
Rose Belle ...	85,910	—	10,859	—	10,859	14.09	12.21
Ferney ...	57,417	6,414	146	—	6,560	13.95	11.42
Riche en Eau ...	85,678	—	10,053	—	10,053	13.54	11.73
TOTAL ...	2,803,483	29,047	319,386	97,6	243,531		12.45

